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A REPORT
TO THE
DEPARTMENT OF PUBLIC WORKS
ON THE
SOUTHERN CROSSING
OF
SAN FRANCISCO BAY

October 1956

Division of San Francisco Bay Toll Crossings
Department of Public Works
State of California

STATE OF CALIFORNIA

Goodwin J. Knight
Governor

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Goodwin J. Knight
Governor

STATE OF CALIFORNIA
Department of Public Works
SACRAMENTO

October 1, 1956

Honorable Goodwin J. Knight, Chairman
California Toll Bridge Authority
Sacramento, California

My dear Governor:

Transmitted herewith is a supplementary engineering report on the Southern Crossing of San Francisco Bay. This report was made necessary by the enactment of legislative amendments, Chapter 67, Statutes of 1956, which revised the approaches on both sides of the Bay. Included in the report are revised estimates of costs of financing and constructing the Crossing and its approaches.

The report was authorized pursuant to my directive of April 16, 1956, to the Division of San Francisco Bay Toll Crossings.

It is recommended that the Department be authorized forthwith to file copies of the report with the Legislature and appropriate committees thereof.

Respectfully submitted,

Frank B. Durkee

FRANK B. DURKEE
Director of Public Works

GOODWIN J. KNIGHT
GOVERNOR

N. C. RAAB
PROJECTS ENGINEER

FRANK B. DURKEE
DIRECTOR

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS

Division of San Francisco Bay Toll Crossings

2054 UNIVERSITY AVENUE
BERKELEY 4, CALIFORNIA

October 1, 1956

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TO FILE No.

Honorable Frank B. Durkee
Director of Public Works
Sacramento, California

Dear Sir:

In compliance with the instructions of your directive of April 16, 1956, we have completed our engineering investigations of an additional highway crossing of San Francisco Bay.

This report revises the estimates of construction costs of the Southern Crossing, with approaches, as provided by Chapter 67, Statutes of 1956, and includes current traffic and financing data.

It is my pleasure to submit herewith the report on this subject covering all work accomplished to date. This report supplements and supersedes, in part, the Report of December 1955.

Respectfully submitted,

NCRaab
N. C. RAAB
Projects Engineer and
Chief of Division

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PART I

INTRODUCTION

SCOPE

This report, a Supplement to the Southern Crossing Report of December 1955, has been prepared to summarize engineering and financial studies made as a result of amendments to the Statutes enacted by the Legislature in 1956. (See Appendix A.) The report embraces the following:

(1) A summary of project engineering to date.

(2) Revised chapters on the San Francisco and East Bay approach systems to conform with the Statutes, as amended in 1956.

(3) Revision of cost, traffic, and revenue estimates.

(4) Proposed current schedules for project financing and construction.

HISTORY OF SOUTHERN CROSSING LEGISLATION

1953 Legislation

In 1953 the State Legislature authorized studies to be undertaken to determine the feasibility of financing and constructing an additional toll bridge or other highway crossing of San Francisco Bay to connect the East Bay communities with the City and County of San Francisco. This legislation was later codified as Chapter 1056, Statutes of 1953. Since enactment, this Statute has been amended by subsequent legislation as briefly described in the following paragraphs:

1954 Legislation

No legislation was enacted which affected the Southern Crossing Project. During the year engineering work began and a "Progress Report" was submitted in December 1954 on the work accomplished to that time. The report indicated the advisability of amending the statutes to clarify points where doubt as to intent existed or which conflicted with previously enacted law.

1955 Legislation

During this year, legislation containing several technical and clarifying amendments, requested by the Department of Public Works, was enacted. (Chapter 304, Statutes of 1955.) Included in the amending legislation was a proviso that certain approach revisions should be studied after the completion of the report to be issued the latter part of the year.

The Report of December 1955, submitted to the Department, contained the estimates of costs of financing and constructing the project.

1956 Legislation

The Supplemental Report of March 1956 contained a discussion of the proposed changes to the approaches as outlined by the Legislature in 1955.

Legislation was enacted (Chapters 40 and 67, Statutes of 1956) to amend Chapter 1056, Statutes of 1953, in the following manner:

(1) To exclude construction of rapid transit train facilities from the restriction prohibiting competing toll structures.

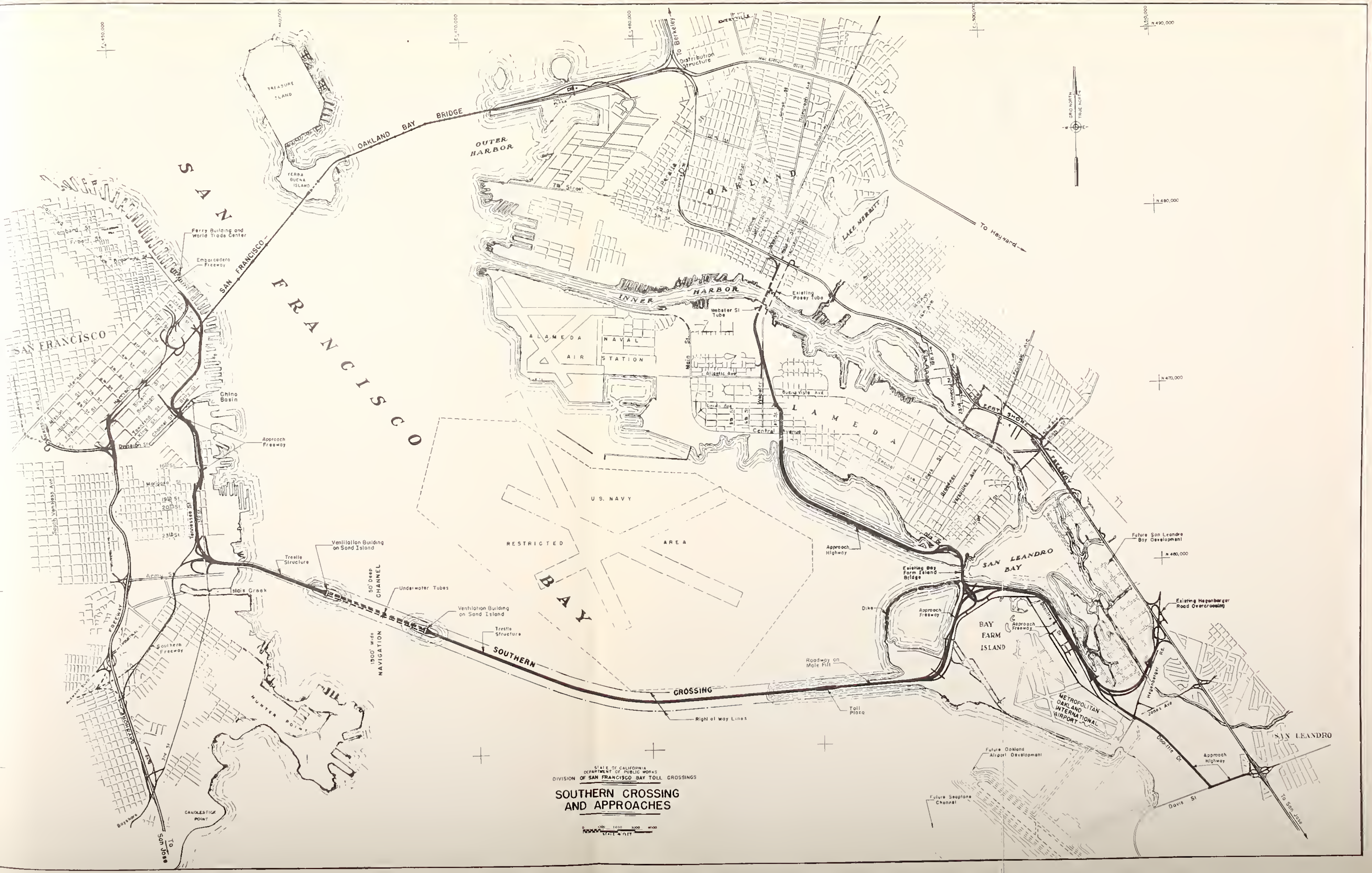
(2) To revise the approach systems on both sides of the Bay.

(3) To provide for the successive issuance of bonds for construction as may be determined by the Toll Bridge Authority.

INITIAL CONSTRUCTION

Results of the financial studies have shown that a bond issue of sufficient amount to construct the entire project as authorized by the Statutes cannot be supported by a 25-cent toll on the San Francisco-Oakland Bay Bridge and the Southern Crossing. As there is considerable opposition to raising tolls on the Bay Bridge, the Statutes were amended to permit stage construction of the project. (See Appendix A, Section 30657.)

Determination of the manner of financing the project is the responsibility of the California Toll Bridge Authority. The Division of San Francisco Bay Toll Crossings is preparing contracts, ready for advertising, for the main overwater crossing, the Webster Street Tube, and portions of the approaches necessary for any initial construction program.



STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF SAN FRANCISCO BAY TOLL CROSSINGS

SOUTHERN CROSSING AND APPROACHES

PART II

PROJECT DESCRIPTION

The Southern Crossing, a new vehicular toll crossing of San Francisco Bay, would be located south of the present San Francisco-Oakland Bay Bridge. The project would provide approximately 23 miles of multi-lane freeways and highways to connect the East Bay communities with the City and County of San Francisco.

TRANSBAY SECTION

The transbay section of the Southern Crossing is planned as a six-lane freeway to handle traffic from the multi-lane approach facilities on both sides of the Bay. Two three-lane roadways are provided on the mole and on the trestles, and two-lane roadways in each of the three tubes under the navigation channel.

The transbay section has been defined as extending from Station 181+40 on the San Francisco side of the Bay, which point is approximately on the present shore line, to Station 580+50 on the Bay Farm Island shore. The total length between these points is 39,910 feet, or 7.56 miles. This length is divided into the several components shown in the tabulation on the following page.

Components of Transbay Section

	Station	Length
West Trestle Structure	181+40 to 225+54	4,414
Transition Section on West Sand Island	225+54 to 233+67	813
Ventilation Building on West Sand Island	233+67 to 234+52	85
Bay Tube	234+52 to 292+48	5,796
Ventilation Building on East Sand Island	292+48 to 293+33	85
Transition Section on East Sand Island	293+33 to 301+46	813
East Trestle Structure	301+46 to 499+64	19,818
Mole Fill (including Toll Plaza)	499+64 to 580+50	8,086
Total length (feet).		39,910
" " (miles)		7.56

When traffic is unbalanced directionally, two tubes can be assigned to vehicles traveling in the direction of greater flow and one to vehicles traveling in the opposite direction. In addition, during periods when traffic volumes do not require more than two lanes in either direction, any one of the tubes may be closed to traffic to allow for maintenance. Thus, this six-lane crossing would provide maximum flexibility and economy of tube operation and maintenance as well as greater safety to traffic.

Sand islands would be constructed at the ends of the tubes on which the transition sections and ventilation buildings are to be located. At these locations the crossing changes from three two-lane roadways in the tubes to two three-lane roadways on the trestles. A length of about 800 feet is provided for each of these transitions so that the lanes can be merged without difficulty to motorists. The ventilation buildings would house the equipment to ventilate the tubes and would also serve as electrical substations.

The toll plaza and the administration and maintenance buildings would be located on the mole fill near the eastern end of the overwater crossing.

The transbay section would be constructed under the following eight contracts:

> Contract No. 2002, Bay Tube and Fills, includes predredging of tube site; constructing, placing, and joining tube segments; placing protective covering over tube; constructing sand islands with ventilation buildings and transition structures thereon; predredging site and placing sand fill for 8,000-foot mole extending from Bay Farm Island; and dredging channel entrance to Islais Creek.
>
> Contract No. 2004, Tube Finishing, includes interior surfacing and other finishing details for the Bay Tube.
>
> Contract No. 2005, Bay Trestle, provides for constructing the two low-level concrete trestles from San Francisco to the west sand island, and from the Mole Fill to the east sand island.
>
> Contract No. 2013, Buildings and Toll Plaza, involves constructing the administration and maintenance buildings, and the toll lane structures.
>
> Contract No. 2017, Paving, consists of paving, constructing curbs and gutters, and installing drainage structures on the mole fill roadways, at the toll plaza, and on the Bay Tube sand islands.

Contract No. 2018, Electrical Work, involves the furnishing and installing all electrical facilities for the entire project including power supply system; roadway lighting systems; communication, supervisory, and signal systems; aids to aviation and navigation; and building power and light systems.

Contract No. 2019, Mechanical Work, includes furnishing and installing tube ventilating systems; building heating, ventilating, and plumbing systems; and pipe lines and related equipment.

Contract No. 2023, Toll Collection Equipment, provides for the installation of all equipment and related items necessary to make a complete and operable toll collection system at the Toll Plaza.

SAN FRANCISCO APPROACHES

The Embarcadero Approach, in the City of San Francisco, would have its northerly terminus in the vicinity of Howard Street, where it would connect to the Embarcadero Freeway, and its southerly terminus at the bridgehead of the transbay crossing. The total distance between these termini would be approximately three and one-half miles. The Approach would be a double-decked structure with three 12-foot traffic lanes on each level for uni-directional traffic. An interchange, to be constructed in the vicinity of Third and Army Streets, would distribute traffic to and from the Southern Crossing, the Southern Freeway, and the city streets.

The freeway in the City of San Francisco would be constructed under the following contract:

Contract No. 2009, Embarcadero Approach, provides for the construction of the entire approach system in San Francisco northward from the bridgehead to its termination with the Embarcadero Freeway at Howard Street, including the Third and Army Interchange and all connections to city streets as specified by the Statutes.

EAST BAY APPROACHES

The East Bay approach would cross Bay Farm Island, as a six-lane divided freeway, to the existing Bridge connecting the Island with the City of Alameda. At the Bridge the approach branches into two separate routes. One branch, a four-lane divided freeway, would follow the south shore of San Leandro Bay to connect with the Eastshore Freeway at Hegenberger Road. A highway extension of this route, from the junction of Doolittle Drive and Hegenberger Road, would follow the present alignment of Doolittle Drive and Davis Street to an intersection with the Eastshore Freeway. The other branch would cross the Bay Farm Island Bridge, thence proceed westerly along the south shore of Alameda to the Webster Street and Posey Tubes, via Eighth Street and the Southern Pacific right-of-way. The Webster Street Tube would be constructed one block west of the present Posey Tube; and, upon its completion, each of these two tubes would be used for uni-directional traffic.

The approach system of freeways and highways in the East Bay are planned for construction under the following contracts:

> Contract No. 2003, Webster Street Tube, includes all work necessary to construct a two-lane tube beneath the Oakland Inner Harbor parallel to the existing Posey Tube.
>
> Contract No. 2012, Alameda Approach, would include placement of fill and constructing a roadway thereon along the southern shore of Alameda and across Alameda between Bay Farm Island Bridge and the Webster Street and Posey Tubes.

Contract No. 2014, Eastshore Freeway Approach, consists of constructing the freeways and highways from the bridgehead across Bay Farm Island to the two specified connections with the Eastshore Freeway at Hegenberger Road and Davis Street.

MISCELLANEOUS

To perfrom other items of work which are of a general nature for the entire project and not necessarily an integral part of the contracts just described, additional contracts have been set up as follows:

Contract No. 2007, Railroad Relocation Work, consists of relocating all railroad tracks and related facilities as necessary to clear the rights of way to construct the approaches in San Francisco and in the East Bay.

Contract No. 2020, Traffic Stripes and Signs, includes the painting of all stripes designating traffic lanes and the construction and installation of directional and warning signs required for the entire project.

Contract No. 2023, Landscaping, would include all work of planting around the buildings and on designated fill slopes to prevent soil erosion.

PART III

FIELD STUDIES

As discussed in the Report of December 1955, field studies for the Southern Crossing had been undertaken to obtain necessary data for use by the design sections. The data obtained were divided into three categories, (1) foundation studies and explorations, (2) surveys and triangulation, and (3) right of way estimates.

FOUNDATIONS

Analysis of data obtained from the foundation exploration contract, completed in the spring of 1955, has continued throughout the year. It is anticipated that an additional foundation exploration contract will be advertised as soon as project financing is completed.

SURVEYS AND TRIANGULATION

Survey and triangulation work during the year has consisted of (1) a continuation of topographical surveys for previously authorized approach routes, (2) a start on surveys for the new approach routes designated in Chapter 67, Statutes of 1956, and (3) establishment of control points on both sides of the Bay.

The fabrication and installation of nine survey towers are to be included as an item of work in the new foundation exploration contract. These towers would be placed in the

Bay along the alignment of the transbay crossing, and would be tied into the triangulation net so that they may be used as points of reference and working platforms during construction.

RIGHT OF WAY

The amendments contained in Chapter 67, Statutes of 1956, whereby certain approach alignments were deleted and others added would necessitate the acquisition of additional property. It was therefore necessary to prepare revised property maps of the areas affected in San Francisco, Alameda, and Oakland so that right of way costs could be determined.

PART IV

TRANSBAY SECTION

The Report of December 1955 contained a detailed discussion of the several component parts of the Southern Crossing transbay section; they are the bay tubes, sand islands, transition structures, ventilation buildings, trestles, mole fill, and toll plaza facilities. The general plan and elevation of the transbay section are shown on Figure IV-1.

No changes have been in the alignment, clearances, or structure type (causeway-tube) as described in the previous report and for which Department of the Army approval was granted in April, 1954. (See Appendix B). Details of the design and proposed methods of construction have been modified or changed to some degree, however, as planning has developed.

Every effort has been made by the staff of the Division to develop a structurally sound and safe traffic handling facility consistent with the latest freeway standards and with the maximum of economy. Planning and construction cost economy would be effected through the repetition and standardization of structural details and units; and maintenance and operation economy by the extensive application of automation.

Figure IV-2 shows typical sections of one of the three parallel subaqueous bay tubes. Positioning and joining details have been developed as shown that will make it possible to obtain a safe, positive connection between individual tube segments. The tube ceiling has been arched to improve ventilation, lighting characteristics, and overhead clearance.

A typical section of the bay trestle is shown on Figure IV-3 and of the mole fill on Figure IV-4.

Contract No. 2002, Bay Tube and Fills, is planned to be the first construction contract advertised for bids. Advertising would follow within a year on Contract No. 2005, Bay Trestle; Contract No. 2018, Electrical Work; and Contract No. 2019, Mechanical Work. The remaining transbay section contracts would be initiated as necessary to complete the overwater crossing within the planned 4-1/2 year construction period.

FIG IV-

Notes:

M.H.H.W = EL +2.90 at Potrero Point.
S.L. = EL 0.00 U.S.C.&G.S. Sea Level Datum of 1929.
M.L.L.W = EL -3.40 at Potrero Point

Coordinates, bearings and distances are on the California Coordinate System Zone 3.
Multiply distances shown by 1.0000708 to obtain ground level distances.

STATE OF CALIFORNIA
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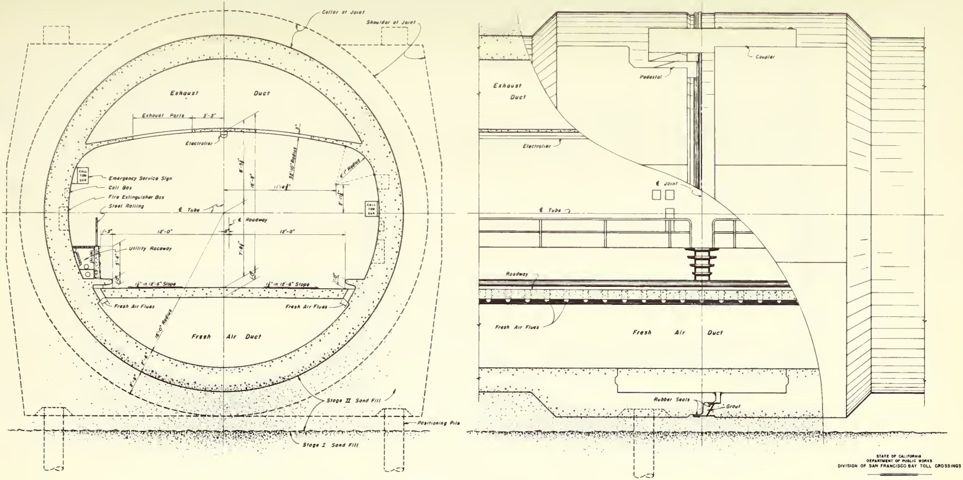
DIVISION OF SAN FRANCISCO BAY TOLL CROSSINGS

SOUTHERN CROSSING

TRANSBAY SECTION

GENERAL PLAN AND ELEVATION



TYPICAL SECTION

TYPICAL ASSEMBLED JOINT

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF SAN FRANCISCO BAY TOLL CROSSINGS

SOUTHERN CROSSING

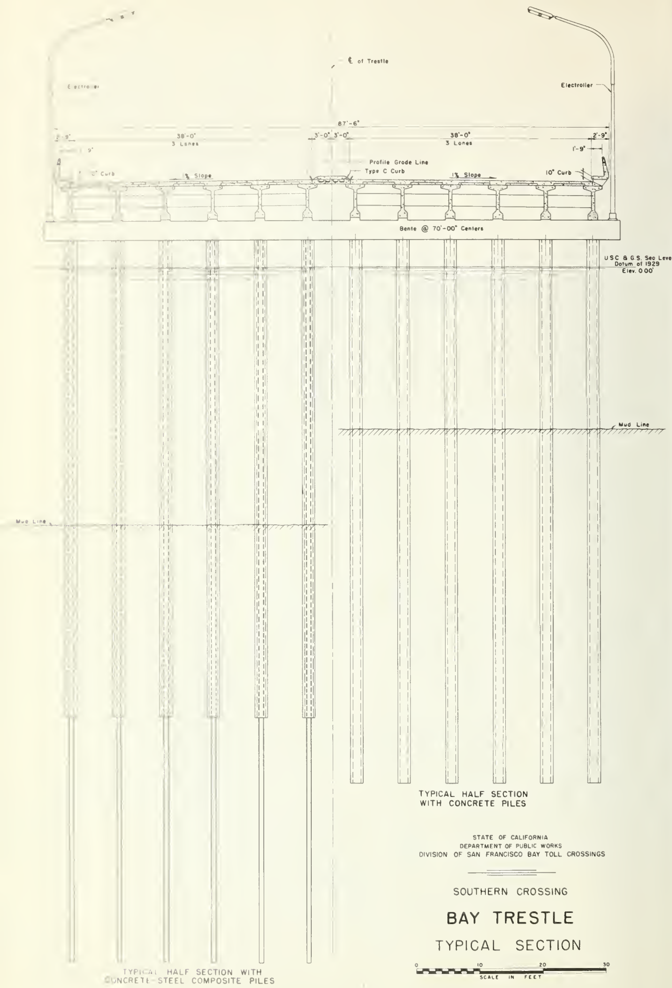
BAY TUBE

SECTIONS

0 2 4 6 8 10
SCALE IN FEET

FIG. IV-2

FIG IV-3



TYPICAL HALF SECTION
WITH CONCRETE PILES

TYPICAL HALF SECTION WITH
CONCRETE-STEEL COMPOSITE PILES

STATE OF CALIFORNIA
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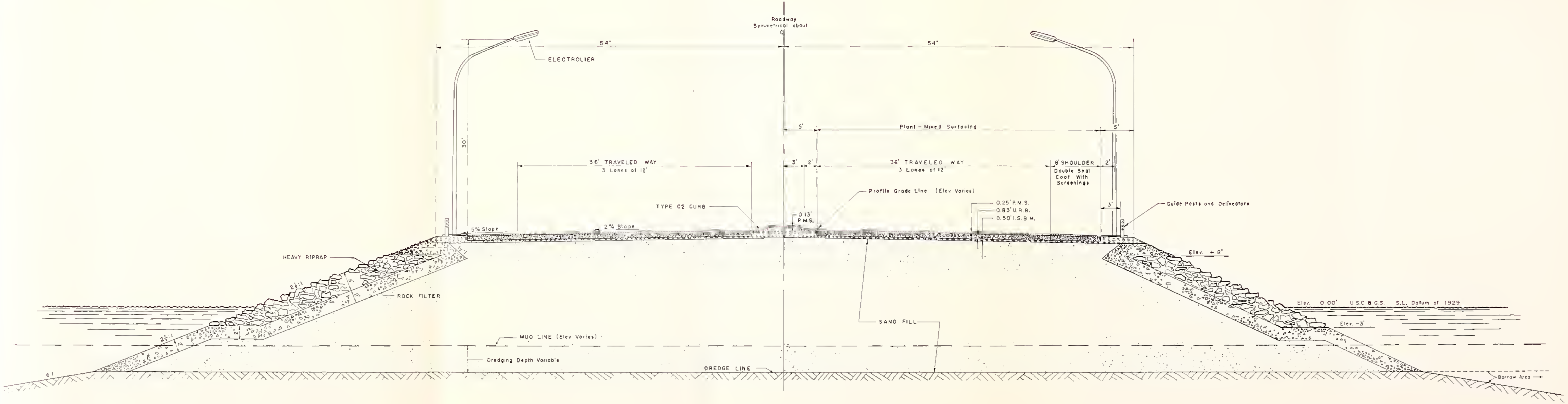
SOUTHERN CROSSING

BAY TRESTLE

TYPICAL SECTION

FIG. IV-4



STATE OF CALIFORNIA
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DIVISION OF SAN FRANCISCO BAY TOLL CROSSINGS

SOUTHERN CROSSING

MOLE FILL

TYPICAL SECTION

0 5 10 15
SCALE IN FEET

PART V

SAN FRANCISCO APPROACHES

Amendments were enacted during the 1956 session of the State Legislature revising the San Francisco approach system to the Southern Crossing. (See Appendix A, Section 30654.) The Statutes now provide for the construction of a six-lane freeway extending from the bridgehead northward to a connection with the Embarcadero Freeway planned by the Division of Highways. At Third and Army Streets a four-lane connection would be made to the Southern Freeway proposed by the City and County of San Francisco. (See Figure V-1.) The planned freeway, the Embarcadero Approach, is shown on Figure V-2 and described below.

EMBARCADERO APPROACH

The Embarcadero Approach would extend westerly from the bridgehead, thence northerly from the Third and Army Interchange to the downtown business and waterfront districts. Throughout its length it is planned as an elevated double-decked freeway structure. It consists of the following components:

(a) The Third and Army Interchange.

(b) A six-lane freeway extending from the Interchange to a connection with the Embarcadero Freeway at Howard Street.

(c) Connections to city streets.

Third and Army Interchange

This interchange would collect and distribute traffic to and from the Southern Crossing, the Southern Freeway, the freeway extending northward, and the city streets. The westerly legs, formerly planned to connect with the Bayshore Freeway in the vicinity of Army Street, have been shifted in a southerly direction to connect with the proposed Southern Freeway.

The structure, located in the area immediately north of Army Street, would extend on both sides of Third Street from the bridghead to Tennessee Street. It would be elevated to clear city streets and railroad tracks.

Transbay on- and off-ramp connections to city streets are planned on Third Street at the intersection of Army Street and at 23rd Street.

Alignment Along Tennessee and Third Streets

Except for minor changes in alignment to make the specified connections to city streets, this section of the Approach would follow the route presented in the Report of December 1955.

Beginning at the Third and Army Interchange and proceeding in a northerly direction, the Approach would follow the east side of Tennessee Street to 19th Street, thence curve eastward between 18th and Mariposa Streets to follow the east side of Third Street to its intersection with Fourth Street.

Connections to city streets, as shown on Figure V-2, are planned along Third Street at 18th, Mariposa, and 16th Streets.

Alignment Along Fourth Street, Townsend, and The Embarcadero

Commencing in the vicinity of the Third and Fourth Street intersection, the Approach alignment would differ from that previously presented in that a high-level crossing of China Basin has been eliminated. In accordance with the amended Statutes the route would curve northwesterly across Third Street to the south side of Fourth Street. At Berry Street it would then veer eastward to The Embarcadero via Townsend Street; thence continue along the westerly side of the latter to connect with the planned Embarcadero Freeway.

It is planned to cross the Channel Street waterway with a fixed span having a vertical clearance of 35 feet above M.H.H.W.

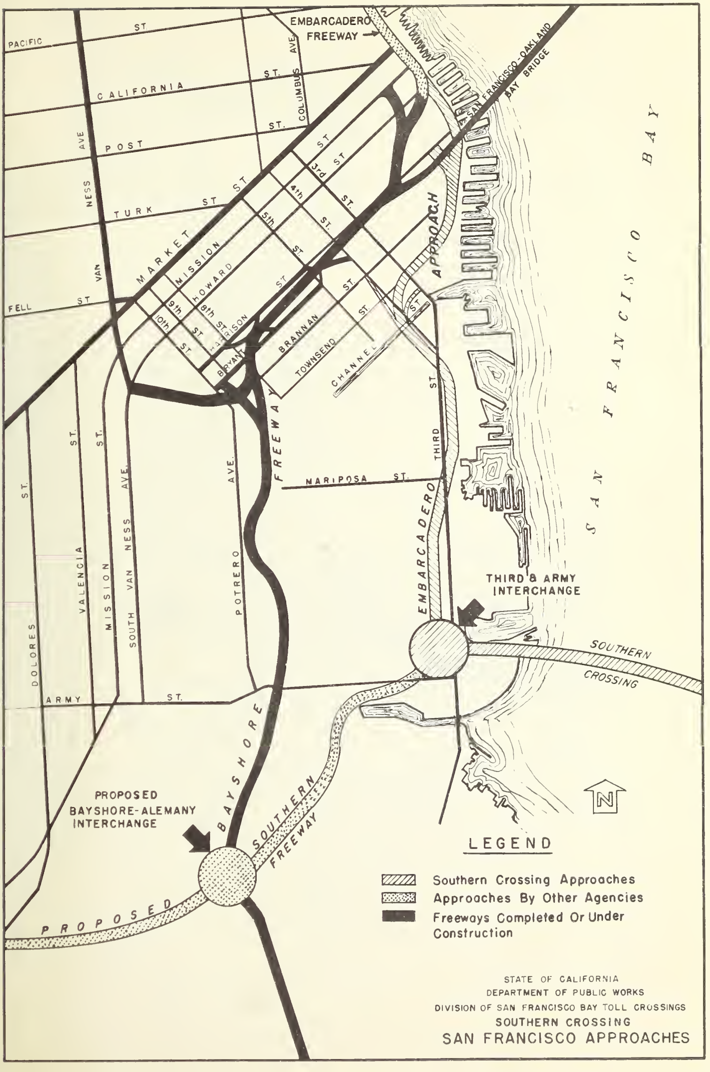
In conjunction with the elevated structure over the Southern Pacific railroad yard, located between Townsend and Berry Streets, connections are planned to serve local, southbound Fourth Street traffic. The planned connections are based upon one-way operation of Third Street northbound and Fourth Street southbound from their intersection.

As shown on Figure V-2 connections to city streets are planned at Berry, Brannan, and Harrison Streets.

Proposed Construction Schedule

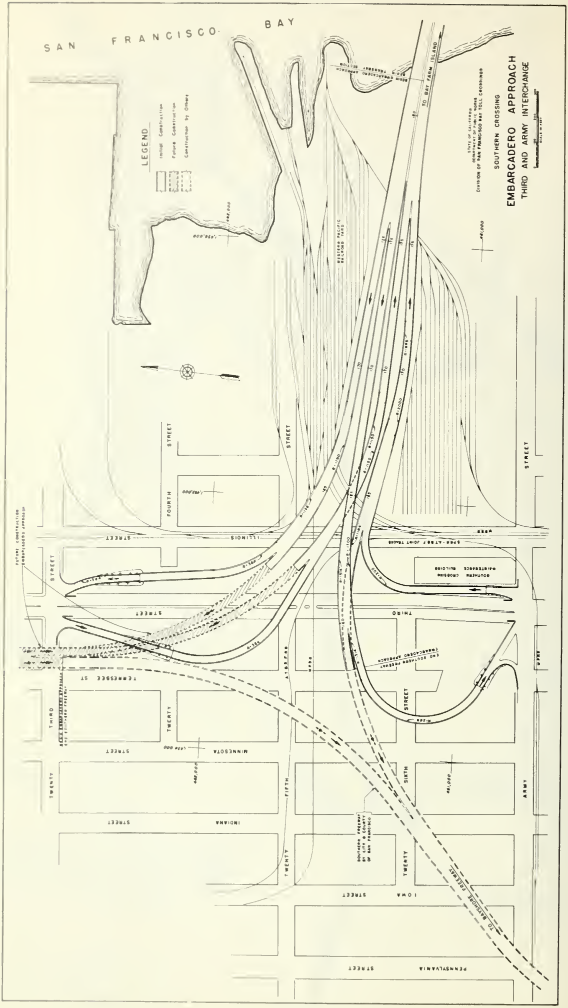
Initial construction of the Embarcadero Approach is planned to consist of building the connection to the transbay section and on- and off-ramps of the Third and Army Interchange. This construction would be sufficient to serve the immediate needs of transbay traffic. (See Figure V-3.)

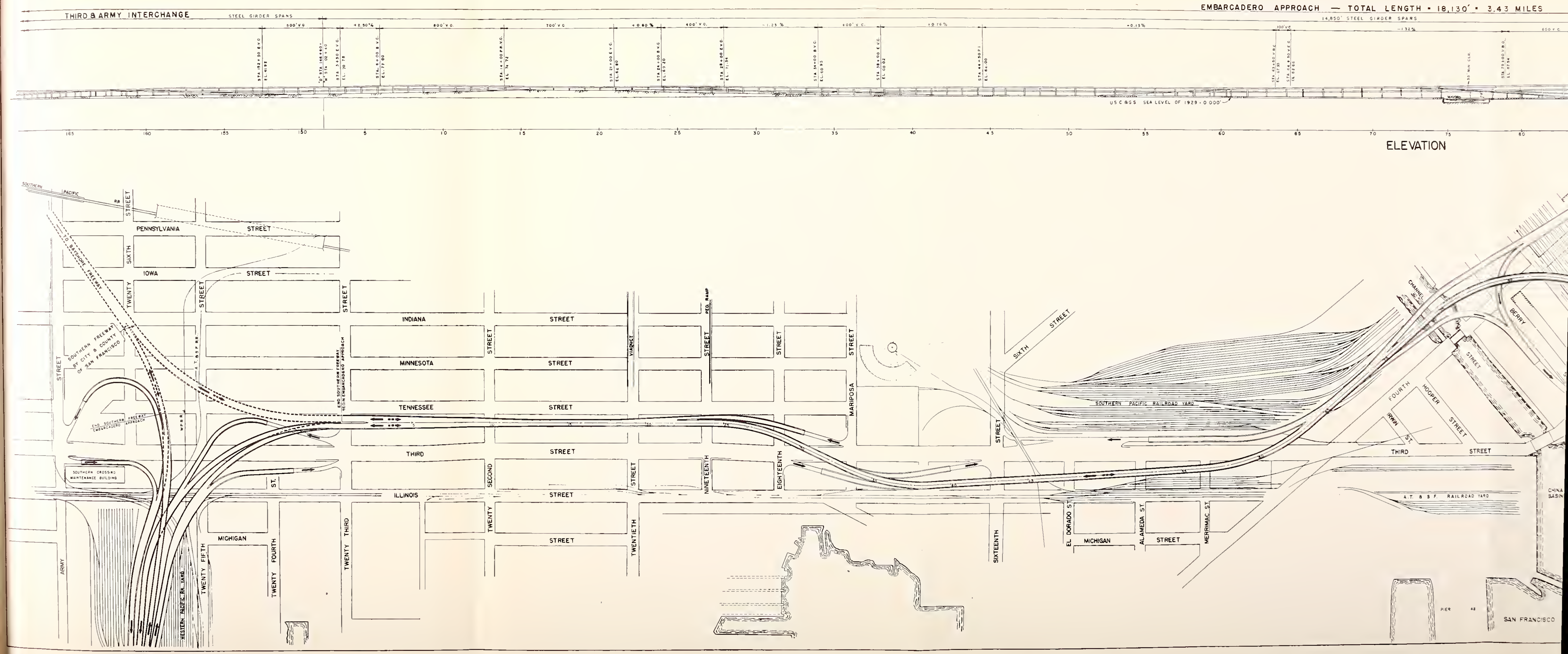
FIG. V-1

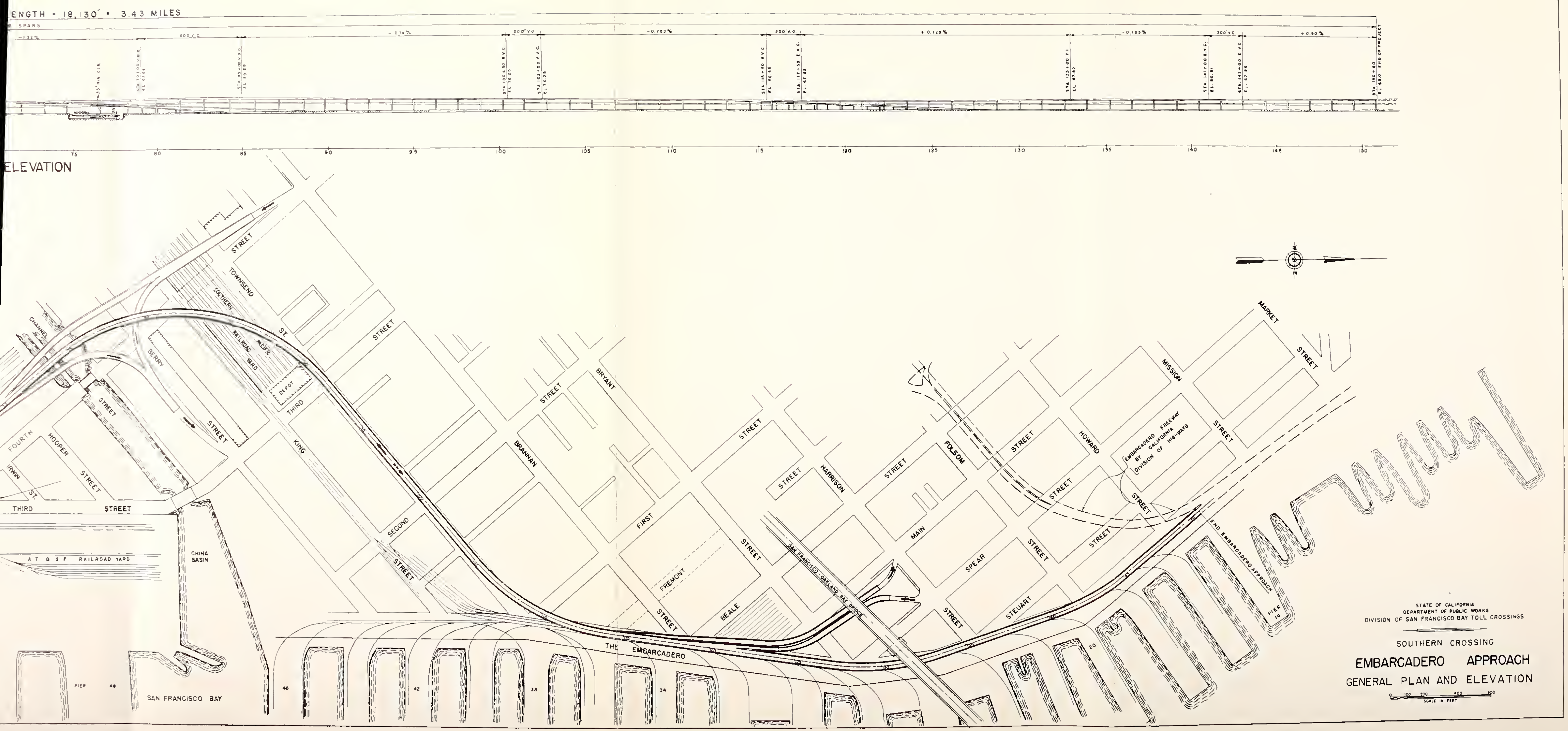


STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF SAN FRANCISCO BAY TOLL CROSSINGS
SOUTHERN CROSSING
SAN FRANCISCO APPROACHES

FIG. V-3


SAN FRANCISCO BAY
LEGEND
Initial Construction
Future Construction
Construction by Others
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF SAN FRANCISCO BAY TOLL CROSSINGS
SOUTHERN CROSSING
EMBARCADERO APPROACH
THIRD AND ARMY INTERCHANGE
SCALE IN FEET
TO BAY FARM ISLAND
BEGIN EMBARCADERO APPROACH
WESTERN PACIFIC RAILROAD YARD
SOUTHERN CROSSING MAINTENANCE BUILDING
END SOUTHERN FREEWAY EMBARCADERO APPROACH
SOUTHERN FREEWAY BY CITY & COUNTY OF SAN FRANCISCO
TO BAYSHORE FREEWAY
FUTURE CONSTRUCTION EMBARCADERO APPROACH
ILLINOIS STREET
THIRD STREET
TENNESSEE ST
MINNESOTA STREET
INDIANA STREET
IOWA STREET
PENNSYLVANIA STREET
FOURTH STREET
TWENTY THIRD STREET
TWENTY FIFTH
TWENTY SIXTH STREET
ARMY STREET


THIRD & ARMY INTERCHANGE
STEEL GIRDER SPANS
EMBARCADERO APPROACH — TOTAL LENGTH = 18,130' = 3.43 MILES
14,850' STEEL GIRDER SPANS
USC&GS SEA LEVEL OF 1929 = 0.000'
ELEVATION
165
160
155
150
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
SOUTHERN PACIFIC RR
PENNSYLVANIA STREET
IOWA STREET
INDIANA STREET
MINNESOTA STREET
TENNESSEE STREET
THIRD STREET
ILLINOIS STREET
MICHIGAN STREET
SIXTH
TWENTY
STREET
TO BAYSHORE FREEWAY
SOUTHERN FREEWAY BY CITY & COUNTY OF SAN FRANCISCO
END SOUTHERN FREEWAY EMBARCADERO APPROACH
END SOUTHERN FREEWAY BEGIN EMBARCADERO APPROACH
A.T. & S.F. R.R.
W.P.R.R.
SOUTHERN CROSSING MAINTENANCE BUILDING
ST.
TWENTY FIFTH
TWENTY FOURTH
TWENTY THIRD
TWENTY SECOND
TWENTIETH
NINETEENTH
EIGHTEENTH
MARIPOSA
SIXTEENTH
VIADUCT
PED. RAMP
ARMY
WESTERN PACIFIC RR. YARD
SOUTHERN PACIFIC RAILROAD YARD
SIXTH STREET
CHANNEL
BERRY
FOURTH
HOOPER STREET
IRWIN ST.
EL DORADO ST
ALAMEDA ST
MERRIMAC ST
A.T. & S.F. RAILROAD YARD
CHINA BASIN
PIER 48
SAN FRANCISCO



STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF SAN FRANCISCO BAY TOLL CROSSINGS

SOUTHERN CROSSING

EMBARCADERO APPROACH

GENERAL PLAN AND ELEVATION

0 100 200 400 600
SCALE IN FEET

PART VI

EAST BAY APPROACHES

The East Bay approach system of the Southern Crossing is divided into two components, the Eastshore Freeway Approach and the Alameda Approach.

The Eastshore Freeway Approach as delineated on Figure VI-1 would extend from the bridgehead on Bay Farm Island to connect with the Eastshore Freeway at Hegenberger Road and at Davis Street. The Approach is subdivided into the following components:

(a) The Bay Farm Island Freeway extending from the bridgehead to the interchange at the southern end of the existing Bay Farm Island Bridge.

(b) The Bay Farm Island Interchange located at the southerly end of the bridge mentioned above.

(c) The San Leandro Bay Freeway, beginning at the Interchange and terminating at the Hegenberger-Eastshore Freeway Interchange.

(d) The Doolittle-Davis Highway Connection starting in the vicinity of the intersection of Doolittle Drive and Hegenberger Road and following Doolittle Drive and Davis Street to the latter's intersection with the Eastshore Freeway.

The Alameda Approach shown on Figure VI-3 would extend from the south end of the Bay Farm Island Bridge westerly along the south shore of Alameda, thence across Alameda via Eighth Street to connect with the Posey and Webster Street Tubes. It would be composed of the following four elements:

(a) The existing Bay Farm Island Bridge.

(b) The Southshore Highway extending across the tidelands along the south shore of Alameda to connect with a prolongation of Eighth Street.

(c) The Crosstown Highway extending along Eighth Street and the Southern Pacific right of way to its connection with the Posey and Webster Street Tubes.

(d) The Webster Street Tube to be located west of and parallel to the existing Posey Tube.

EASTSHORE FREEWAY APPROACH

Bay Farm Island Freeway

From the bridgehead on Bay Farm Island, this six-lane divided highway would extend northerly across the island to the existing bridge connecting with City of Alameda. It would be located west of and adjacent to Maitland Drive and County Road.

The Statute, as amended, now require two interchanges be constructed in this portion of the Approach and are shown on Figure VI-1.

Bay Farm Island Interchange

This interchange, to be located on the northwesterly shore of the Island, would directly interconnect the existing Bay Farm Island Bridge, the Bay Farm Island Freeway, and the San Leandro Bay Freeway.

San Leandro Bay Freeway

This four-lane divided freeway, with provisions for future widening to six lanes, would extend from the Bay Farm Island Interchange easterly along the north shore of the Island and parallel to Doolittle Drive, thence across the tidal mud flats at the east end of San Leandro Bay to parallel Hegenberger Road to its connection with the Eastshore Freeway.

On- and off-ramps connections would be made to Doolittle Drive and Hegenberger Road which would be utilized as frontage roads to serve local traffic. (See Figure VI-1.)

Doolittle-Davis Highway Connection

The Statutes have been amended to include an extension of the San Leandro Bay Freeway as a highway along Doolittle Drive to its intersection with Davis Street, thence along the latter to its connection with the Eastshore Freeway.

Proposed Construction Schedule for Eastshore Freeway Approach

Under the initial construction program it is planned to construct the Bay Farm Island Freeway and Interchange. (See Figure VI-2.)

ALAMEDA APPROACH

Bay Farm Island Bridge

This existing structure connecting Alameda to Bay Farm Island has been fully described in previous reports. No changes are contemplated for this bridge.

Southshore Highway

The Report of December 1955 described this portion of the Approach as a freeway extending from the existing Bay Farm Island Bridge westerly along the southerly shore of Alameda to a prolongation of Main Street. Amending legislation enacted in 1956 would extend the Approach westerly as a highway, rather than a freeway, to connect with a southerly prolongation of Eighth Street. An interchange would be provided at the north end of the Bay Farm Island Bridge with on- and off-ramps in both directions.

Crosstown Highway

This route across Alameda to the Webster Street and Posey Tubes, shown on Figure VI-3, replaces the circuitous Main-Atlantic Freeway described in the 1955 Report. The present alignment is more direct, following Eighth Street to Lincoln Avenue, thence along the Southern Pacific right of way to Atlantic Avenue, and then cutting diagonally across Webster Street to the Tubes. (See Appendix A, Section 30654.)

To accommodate four lanes of traffic it will be necessary to widen Eighth Street to Lincoln Avenue. At that point an overhead structure would be required to carry the Highway over the railroad tracks at Atlantic Avenue. On- and off-ramps to the Tubes are provided as specified.

Webster Street Tube

This new two-lane vehicular tube to carry traffic from Oakland will be located approximately one block west of the existing Posey Tube. Design and construction of the tube segments for this facility would be the same as that of the main Southern Crossing tubes.

Proposed Construction Schedule

Under present planning only the Webster Street Tube, with appropriate connections to city streets, would be built during the initial stage of project construction.

FIG VI-1

Notice. Coordinates, Bearings and distances are on the California Coordinate System Zone 3. Multiply distances shown by 1.0000708 to obtain ground level distances

M.H.H.W. = Elev. + 2.90 at Potrero Point
S.L. = Elev. 0.00 = U.S.C.&G.S. Sea Level Datum of 1929.
M.L.L.W. = Elev. − 3.40 at Potrero Point

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF SAN FRANCISCO BAY TOLL CROSSINGS

SOUTHERN CROSSING

EASTSHORE FREEWAY APPROACH

GENERAL PLAN

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF SAN FRANCISCO BAY TOLL CROSSINGS

SOUTHERN CROSSING

EASTSHORE FREEWAY APPROACH

BAY FARM ISLAND FREEWAY

GENERAL PLAN

NOTE

Coordinates, bearings, and distances shown are on the California Coordinate System, Zone 3. Multiply distances shown by 1.0000708 to obtain ground level distances.

M.H.H.W = El. + 2.90 at Potrero Point
S.L. = El. 0.00 U.S.C.&G.S. Sea Level Datum of 1929.
M.L.L.W. = El. − 3.40 at Potrero Point

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF SAN FRANCISCO BAY TOLL CROSSINGS

SOUTHERN CROSSING

ALAMEDA APPROACH

GENERAL PLAN

0 500 1000 1500
SCALE IN FEET

PART VII

COST ESTIMATE, PLANNING, AND CONSTRUCTION SCHEDULES

COST ESTIMATE

The cost estimate of the Southern Crossing, including approaches, was prepared by this Division with the cooperation of other state, county and municipal agencies and various contracting firms.

Quantity Estimate

Before reliable cost estimates could be prepared, it was necessary to determine material quantities. All planning for the transbay crossing and approaches was completed to a point where calculation of material quantities could be made with reasonable accuracy.

Costs

The following methods were used to estimate the project cost:

1. From the large volume of recent bridge and highway construction in the San Francisco Bay Area, unit cost bids submitted for comparable type and magnitude of work were selected, analyzed, and applied to calculated material quantities for the Southern Crossing.

2. Where unit costs for comparable work were not available, contract costs were developed by estimating the cost of labor, materials, and plant required to perform the work. These costs were compared to work of similar nature being performed in other parts of the United States.

3. The proposed design, specifications, construction schedules, and site conditions were discussed with qualified producers and contractors, and their advice was sought relative to costs.

4. To the estimated current costs a factor was applied to determine the costs expected to prevail during the time of actual construction. This factor was determined by developing a trend based upon a careful review and analysis of construction cost indices, including the Engineering News-Record Construction Cost and Building Cost indices, over the past two decades, with particular attention devoted to the last four years. The data thus studied gives strong evidence of continued rising construction costs.

The contract construction cost presented herein allows for an estimated increase based upon the data studied. Any sharp deviation in the cost trend will make it necessary to revise the estimate accordingly.

Engineering, Administration, Legal Counsel, and Insurance

An allowance has been added to the estimated construction cost of the project for administration and operational cost and insurance. This allowance is comparable to that experienced on the San Francisco-Oakland Bay Bridge and the Richmond-San Rafael Bridge, during construction.

Contingencies

To provide for unforeseen additional items, increased material quantities, and miscellaneous extra costs, an appropriate allowance has been made in the estimated cost for each item of work. This also serves as a further safeguard against increases in labor and material costs.

Rights of Way

The cost estimates for right of way, including utility relocation work, are based upon fair market value; comparable sales and listings; reproduction costs less depreciation; assessed valuation; costs of acquisition; and an allowance for contingencies.

Construction Costs

The total estimated cost of construction includes all of the foregoing items, namely; costs for constructing the project; an allowance for engineering, administration, legal counsel, and insurance services; right of way, including utility relocation work; and an allowance for contingencies. Figures IX-1 and IX-3 show a breakdown of costs for the various components of the project.

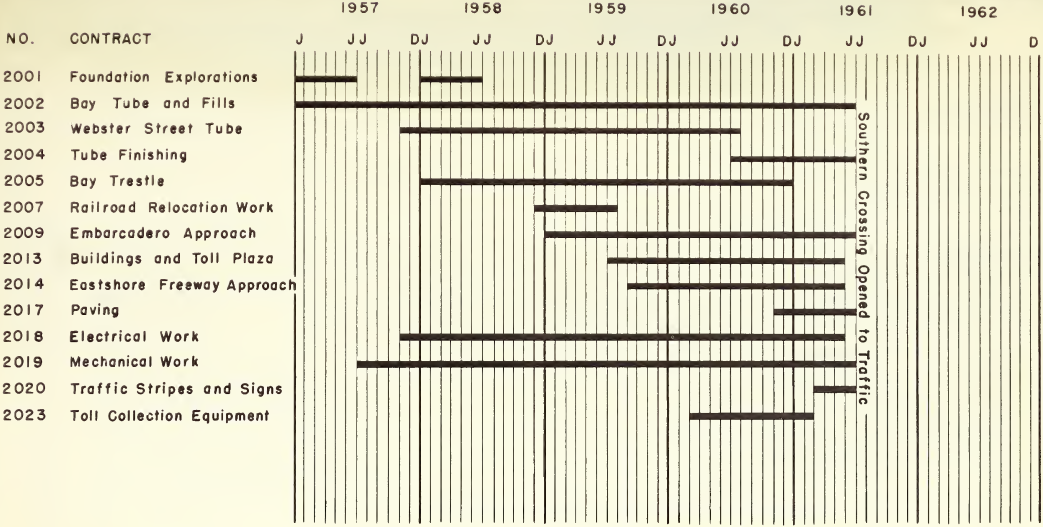
PLANNING

It is assumed that revenue bonds for the project cannot be marketed until the cost of the major contracts are known within narrow limits and these costs assured by guaranteed proposals from contractors.

Contract plans and specifications for the principal items of work on the transbay crossing can be completed by the early part of 1956. The plans and specifications for the approaches and supplementary facilities will be completed at a later date as they will not be a factor insofar as guaranteed costs are concerned.

CONSTRUCTION SCHEDULES

A reasonable estimate of time required for project construction is shown in Figures VII-1 and VII-2. These schedules are based upon the assumption that construction is started by January 1957.



Note: If construction is started after January 1957, completion will be correspondingly delayed.

STATE OF CALIFORNIA
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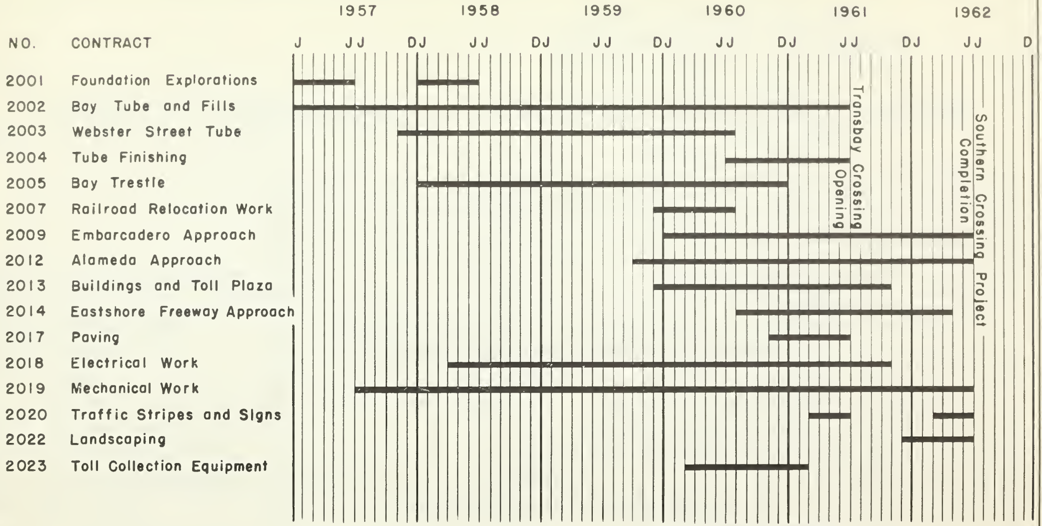
DIVISION OF SAN FRANCISCO BAY TOLL CROSSINGS

SOUTHERN CROSSING
CONSTRUCTION SCHEDULE
WITH 25 CENT BASE TOLL

FIG. VII - 1

FIG. VII-2



Note: If construction is started after January 1957, completion will be correspondingly delayed.

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF SAN FRANCISCO BAY TOLL CROSSINGS

SOUTHERN CROSSING
CONSTRUCTION SCHEDULE
WITH 35 CENT BASE TOLL

PART VIII

TRAFFIC AND REVENUE

The Division of San Francisco Bay Toll Crossings engaged the firm of Coverdale and Colpitts, Consulting Engineers, to advise on traffic and revenue. The following text and figures, comprising Part VIII, have been prepared by this firm.

SCOPE

The purpose of this part of the report is to estimate the volume of traffic available to both the San Francisco-Oakland Bay Bridge (hereinafter referred to as the "Bay Bridge") and the additional highway crossing (hereinafter referred to as the "Southern Crossing") and the distribution of such traffic between them; the revenue corresponding to the volume of vehicular traffic; the maintenance and operating expenses, and the balance remaining for servicing the debt to be incurred in the construction of the Southern Crossing and its approaches. Chapter 1056, Statutes of 1953 as amended by Chapter 304, Statutes of 1955 and Chapters 40 and 67, Statutes of 1956, which authorizes the construction of the Southern Crossing, provides that this Crossing is to be financed by the application of all revenues earned on both the Bay Bridge and Southern Crossing after payment of all maintenance and operating expenses and insurance on both facilities. Therefore, it is necessary to project the combined traffic and revenues of both facilities.

A complete description of the Southern Crossing and its approaches; the estimated costs thereof, in stages, and scheduled dates of completion are contained in another part of this report, to which reference is hereby made for information as to these matters.

SOURCES OF TRAFFIC

The sources of traffic available are:

(a) Bay Bridge - This by far the most important source of traffic.

(b) San Mateo-Hayward Bridge - Such vehicles as may be diverted therefrom to a Southern Crossing and which will be in addition to any vehicles now carried by the Bay Bridge.

(c) Such traffic as may be induced either because of a new and improved facility serving areas not now adequately served by either of the existing bridges, or stimulated by relief of existing congestion on the Bay Bridge.

SOURCES OF INFORMATION AS TO VOLUME OF TRAFFIC AND ITS DISTRIBUTION

The volumes of past and present transbay vehicular traffic carried by the Bay Bridge, the San Mateo-Hayward and Dumbarton Bridges, as well as the maintenance and operating expenses and the financial results of operation, are available from the records of the San Francisco-Oakland Bay Bridge. Other available information of prime importance includes:

The results of origin and destination surveys made during 1946 and 1947 by the Bay Area Metropolitan Traffic Survey in co-operation with the United States Bureau of Public Roads and the "Traffic Report, San Francisco Bay Metropolitan Area" and "Map Exhibits" thereto, prepared by District IV, California Division of Highways and published in June 1949;

Basic interview data relating to origins and destinations of transbay passenger vehicles obtained by the Consulting Engineers to the Bay Area Rapid Transit Commission during the spring of 1954 provided through the courtesy of the Commission and its engineers;

The results of a survey of origins and destinations of trucks crossing the Bay Bridge and the San Mateo-Hayward Bridge made during March 1955 by the San Francisco-Oakland Bay Bridge personnel;

Traffic and Operating records of Golden Gate Bridge, furnished by the courtesy of the Golden Gate Bridge and Highway District;

Report entitled "Regional Rapid Transit" prepared for San Francisco Bay Area Rapid Transit Commission by Parsons, Brinckerhoff, Hall & Macdonald, dated January 5, 1956;

The results of previous studies made by Coverdale and Colpitts, including those for the Bay Bridge made in 1936 and subsequent years; the Richmond-San Rafael Bridge, 1951 and subsequent years; the Carquinez Bridge, 1955; operations of the Bridge Railway, 1953; Estimated Traffic and Earnings of the Southern Crossing and San Francisco-Oakland Bay Bridge, November 1, 1955;

Statistical information related to the past, present and prospective development of the Bay Area, both that contained in fundamental publications such as the United States Bureau of the Census and that provided by other public and private agencies to which credit is given wherever the material is used.

BASIC TRAFFIC

Since the basic traffic from which the Southern Crossing will draw is that now carried by the Bay Bridge and the San Mateo Bridge there are included here three tables showing the volume of traffic on these facilities since their opening:

> The vehicular revenue traffic on the Bay Bridge is presented on Table VIII-1;
>
> The passengers carried by the Bridge Railway and the Key System Buses on Table VIII-2; and,
>
> The vehicular traffic on the San Mateo Bridge on Table VIII-3;
>
> The vehicular traffic on the Bay Bridge and on other crossings in the area, month by month, is shown by Figure VIII-1 and the passenger crossings on Figure VIII-2.

From Table VIII-1 it will be observed that the vehicular traffic on the Bay Bridge has been increasing steadily since its opening in November 1936 but at a declining rate for the past several years. That for 1954 was actually less than that in 1953, but the upward trend appears again in 1955 which shows an increase over 1954 of 3.6 per cent. The figures for 1953 are questionable for comparative purposes because of the strike on the Key System from July 24 to October 7 of that year, which by depriving patrons of the use of the Bridge Railway and Key buses forced them to the use of private automobiles, thereby increasing the vehicular traffic above normal. In 1955 the Bay Bridge carried 31,242,000 revenue vehicles.

From Figure VIII-2 it will be seen that the total number of passengers crossing the Bay Bridge has fallen from a peak of approximately 92,000,000 in 1945 to 70,000,000 in 1954 and that the present trend appears to be very slightly downward.

From Table VIII-2 it will be seen that the total revenue passengers carried by the Key System, both by train and by bus, decreased from a peak of 34,926,000 in 1945 to 9,972,000 in 1955; revenue train passengers decreased in the same period from 26,469,000 to 5,836,000 and revenue bus passengers from 8,457,000 to 4,136,000. The 1953 strike caused a sharp reduction in passengers, and since resumption of service in October 1953 the traffic has continued to decline. The base fare on the trains was increased as of November 30,1953, from 35 cents a trip to 50 cents a trip; after September 1, 1956 the fare will be 46 cents. The passengers formerly using the Bridge Railway have not all transferred to the use of automobiles, for, although the number of automobiles has increased moderately during that same period of time, the increase in automobiles is not sufficient to account for the decrease in mass transit passengers. The future of the Bridge Railway is unpredictable at the present time. The Key System has applied to the Public Utilities Commission for permission to abandon all rail service, including that over the Bridge, and hearings thereon have been held but no decision has yet been given. If such rail service were to be abandoned the passengers would be carried, some in buses and some by private automobile. The Bridge revenue would be somewhat increased but at the expense of increased congestion.

A development of mass rapid transit facilities throughout the Bay Area such as may result from the activities of the Bay Area Rapid Transit Commission would affect the future of this part of the Bridge facilities. The "optimum" plan recommended by the Consulting Engineers in the report to the Bay Area Rapid Transit Commission of January 5, 1956 would provide a transbay subaqueous tube in the general location of the Bay Bridge, and in the "minimum" plan would provide for the use of the Bridge Railway as a part of the Regional System. The restriction as to the construction of crossings competitive with the Bay Bridge and the Southern Crossing provided by Chapter 1056, Statutes of 1953, as amended by Chapter 304 of the Statutes of 1955, was removed insofar as such restriction related to the construction and operation of a rapid transit crossing exclusively for trains by Section 30354.5, added by Chapter 40, Statutes of 1956.

The possible effect of the construction of a rapid transit tube on the Bay Bridge and the Southern Crossing traffic is dealt with in a subsequent part or this report.

The current increase of vehicular traffic on the Bay Bridge may be due to relief of congestion in the peak hours due to the fact that passenger cars are now permitted on the lower deck in the direction of maximum flow of traffic during peak hours, - in the morning westbound, and in the evening eastbound. This change has facilitated the movement of traffic in the peak period, and has somewhat reduced the time formerly required to traverse the Bridge at peak hours.

If rail service is abandoned entirely the space on the lower deck of the bridge now occupied by the railway could be floored over and made available for use by motor vehicles thereby increasing the capacity of the Bay Bridge. No funds, however, are now available for such remodeling.

Table VIII-3 shows that the vehicular traffic on San Mateo-Hayward Bridge has been increasing at a very rapid rate through 1954. In 1955 the rate of increase was 4.8 per cent over 1954, and the number of vehicles carried was 2,895,100.

The sum total of vehicles now using the Bay Bridge and those using the San Mateo-Hayward Bridge constitute the pool from which the Southern Crossing will derive its traffic.

METHOD OF ESTIMATING THE VOLUME OF VEHICULAR TRAFFIC ALLOCATED TO THE SOUTHERN CROSSING

The general approach to this part of the problem was to determine how many vehicles now using the Bay Bridge and the San Mateo-Hayward Bridge would be benefited by the Southern Crossing and consequently would be attracted to it and be diverted from the present crossings. As has been stated before, traffic diverted from the Bay Bridge does not affect the over-all financial results, but it does affect the capacities of the facilities to be provided. The benefits are measured by savings in time, in distance and in relief from congestion and reduced risk of accidents.

In order to measure the volume of vehicles which would logically be affected, the area on both sides of the Bay was divided into zones (generally the zones or groups of zones used by the Bay Area Rapid Transit Commission in estimating origin and destination of potential rapid transit passengers) both with reference to the Bay Bridge and, separately, with reference to San Mateo-Hayward Bridge. The individual zones were used primarily for analyzing prospective future growth. For purposes of analyzing traffic flow the zones were grouped in such a way that vehicles traveling from or to each group would have to pass a point common to the route by way of an existing crossing and to the route by way of the Southern Crossing. With reference to the Bay Bridge, 15 common points were established on the west side and 18 on the east side of of the Bay; and, with reference to the San Mateo-Hayward Bridge 22 on the west and 16 on the east side. The locations of these common points, as well as the zone boundaries, are shown on the maps Figures VIII-4 and VIII-4A.

Pattern of Traffic Flow

The zone-to-zone distribution of vehicles was estimated as follows:

Through the courtesy of the San Francisco Bay Area Rapid Transit Commission we were furnished original and detailed information obtained during the course of an origin and destination survey made in the spring of 1954. These data covered a 10 per cent sampling of passenger car traffic obtained by a 24-hour interview at the Bay Bridge toll booths in April 1954, and a 16-hour interview period at the San Mateo-Hayward Bridge toll booths in March 1954. A review by us of procedures used indicated the data to be suitable for use in this report. The results of the counts were expanded to a full day by comparison with the actual records of passenger car traffic both on the Bay Bridge and on the San Mateo-Hayward Bridge on the days on which the interviews were made, and to the average annual daily traffic by comparison of those specific days on each of the respective bridges with the actual average daily traffic on each of the bridges for the full year 1954.

As to trucks, the San Francisco-Oakland Bay Bridge personnel made an origin and destination survey for a 24-hour period on the Bay Bridge and on the San Mateo-Hayward Bridge in March 1955. The interviews covered all of the vehicles passing the toll booths. The volumes for the days were expanded to an average day for the year by comparison with the Bridges' records for a full year.

A study of zone-to-zone distribution indicated a general conformity with patterns indicated by the 1946-1947 findings of the Bay Area Metropolitan Traffic Survey.

Based on these data, tabulations were prepared for each bridge, classifying the average daily traffic by passenger vehicles and trucks and allocating the indicated portion from each common point on one side of the Bay to every common point on the other side. The application of these analyses is shown later under the discussion of distribution of vehicles between the existing bridges and the Southern Crossing.

Basis of Allocation of Vehicles to the Southern Crossing

The primary basis of allocating vehicles between the Southern Crossing and the other two crossings was by consideration of relative times and distances involved in each movement between common points. These comparative times and distances were based on field observations and test trips made by members of our staff during the period March to May 1955, under various traffic conditions, at peak and off-peak periods, supplemented by computed distances and times on the Southern Crossing and its approaches and on the various freeways not yet completed.

Basic Assumptions

In allocating vehicles to the Southern Crossing, and in computing relative times and distances, the following assumptions have been made:

1. That the part of the Southern Crossing between Third and Army Streets in San Francisco and Bay Farm Island, and the Webster Street Tube between Alameda and Oakland with its approaches, will be complete and ready for traffic by July 1961; - this is referred to later as the "Shore to Shore" Crossing - ;
2. The completion of the approaches, if the Bridge is financed on the "Shore to Shore" basis, will depend upon the requirements of the Bond Resolution with regards to the additional sale of bonds.
3. That the base toll rates on the Southern Crossing and the Bay Bridge will be the same and that the toll rates on San Mateo-Hayward Bridge will remain substatially as at present;
4. That the following highway and street improvements will have been completed:
    - (a) Bayshore Freeway, - from San Jose to a connection with Embarcadero Freeway.
    - (b) Central Freeway, - from a connection with the Bayshore Freeway at Division Street to a connection with Van Ness Avenue near Golden Gate Avenue and Turk Street.
    - (c) Embarcadero Freeway, - from a connection with the approach to the Southern Crossing to Broadway.
    - (d) Southern Freeway, - from Junipero Serra Boulevard just south of the city limits to the vicinity of San Jose Avenue and Monterey Boulevard, thence by the location of Alemany Boulevard to connect with the Bayshore Freeway and the Embarcadero Approach of the Southern Crossing at Third and Army Streets.

(e) Western Freeway, - extending northerly from a connection with the Southern Freeway near Junipero Serra Boulevard to the Golden Gate Park and turning east to connect with the Central Freeway near Oak Street.

(f) Crosstown Freeway, - from the Southern Freeway near San Jose Avenue along Bosworth Street and O'Shaugnessy Boulevard, Woodside Avenue to a connection with Western Freeway. At present the freeway section will extend slightly beyond Portola Drive.

(g) Market-Portola Expressway, - a four-lane divided highway to be provided between Market and 17th Streets to the interchange with Western Freeway.

(h) Geary Street Expressway, - a six-lane divided highway between Presidio Avenue and Franklin Street.

(i) Eastshore Freeway, - complete from Carquinez Bridge to San Jose with all its planned interchanges.

(j) McArthur Freeway, - Distribution Structure to Park Boulevard.

(k) Southerly Extension of Mountain Boulevard to Ascot Drive.

(l) Bancroft Expressway, - improvements which will facilitate access from parts of Oakland to the Southern Crossing by way of High Street, Alameda.

Distribution of Bay Bridge Vehicles

The basis of allocation of vehicles was as follows: Where there was no difference in time or distance, traffic was divided equally between the facilities. In cases where the time saved was five minutes or 20 per cent of the total trip time, 100 per cent of the vehicles were allocated to the facility affording the saving; for a time saving of 10 per cent the traffic was divided 60-40 per cent basis; and for a time saving of 15 per cent, 75-25 per cent basis. On this basis, even if the time by the Southern Crossing was up to 2-1/2 minutes longer, a small percentage of traffic was assigned to it. Peak-hour traffic and off-peak-hour traffic were analyzed separately.

Speeds used in estimating times of passenger car trips were: on city streets in congested areas, 12-15 miles per hour; in city streets, under ordinary conditions 20 miles per hour; on freeways 50 miles per hour; on Bay Bridge and approaches 40 and 50 miles per hour, respectively; on Southern Crossing, except in tubes, 50 miles per hour; in tubes, 35.

An analysis of the flow of passenger car traffic crossing the Bay Bridge indicates that in only 48 common point-to-common point movements out of 270 does the Southern Crossing offer any time savings. These point-to-point trips represent 16.4 per cent of the total Bay Bridge passenger car movement. Point-to-point movements between all the common points on the west side of the Bay and points 2 to 10, inclusive, on the east side - that is, those on the Distribution Structure and along MacArthur Boulevard as far east as Park - account for 59 per cent of the total Bay Bridge passenger automobile crossings, and on these trips the indicated advantage of the Bay Bridge in distance ranges from practically nothing in one case to more than 14 miles, and in time, at off-peak hours, from five to more than 18 minutes; the prevailing time saving being 10 to 15 minutes. The time saving in favor of the Bay Bridge at peak hours (applicable to about 35 per cent of the daily traffic) is 2.4 minutes less than at off-peak periods.

A computation in which the average daily traffic for each point-to-point movement was allocated between the Bay Bridge and the Southern Crossing, dealing separately with peak and off-peak traffic, produced a weighted average diversion from the Bay Bridge to the Southern Crossing of 13.35 per cent assuming all of the approaches to the Southern Crossing completed, and 7.7 per cent assuming the Crossing open only from Army and 3rd Streets, San Francisco, to Bay Farm Island, with the bridge to Alameda and with the Webster Street tube between Alameda and Oakland.

A similar study of truck movements indicated that 13.35 per cent of pickup and panel trucks, 12.6 per cent of two-axle, six-tire trucks, and 14.8 per cent of three-, four-, five- and six-axle trucks would be diverted; a weighted average of all trucks of 13.7 per cent.

The only buses diverted were the Key System Alameda buses, Routes O and W, and the Hayward buses, Route R, which make no stops between the San Francisco bus terminal and 51st Street, Oakland. These amount to 58,000 trips a year.

Borderline Cases

In addition to the theoretical diversions described above there will be additional diversions resulting from the desire of riders to use the less crowded facility or that with entrances most easily reached, even at some disadvantage as to distance and in time.

A review of all the comparative times and distances in the 46 point-to-point movements where these borderline cases appear indicates that the substitution of rates of diversion which, in our judgment, are more appropriate than those derived from the formula produces total diversions approximately 10 per cent greater than the theoretical. For that reason we have added to allow for borderline cases 10 per cent of the passenger vehicles diverted from the Bay Bridge as computed by formula.

Distribution of San Mateo-Hayward Bridge Vehicles

Diversions from the San Mateo Bridge to the Southern Crossing were estimated in accordance with the same principles as those described above for the Bay Bridge. The location of the common points and the freeways and approaches for both San Mateo-Hayward Bridge and Southern Crossing are shown on Figures VIII-4 and VIII-4A.

The heaviest single movement both of passenger cars and trucks was between the common point at San Mateo on the Bay Shore Freeway and the common point at the junction of Eastshore

Freeway and the entrance to the Posey Tube in Oakland. This accounts for over 15 per cent of the total. The traffic passing through the common point at San Mateo accounts for over 68 per cent of the total crossings by the San Mateo Bridge. The point-to-point movements which we believe will all be diverted to the Southern Crossing account for 11.6 per cent of all the vehicles. In the movements in which diversions will occur the advantages of the Southern Crossing both as to time and distance are substantial; the savings in time ranging from a few minutes to over half an hour.

Since the base toll on the San Mateo Bridge for automobiles is 35 cents, the diversions are estimated on two different bases. One computation was made on the basis of equal tolls and the other on the basis of a 10-cent differential in favor of the Southern Crossing.

The estimated diversion of passenger cars from San Mateo-Hayward Bridge to the Southern Crossing, complete with all approaches, based on an analysis of each point-to-point movement at the 1954 traffic level, was 36.0 per cent at equal tolls. The rate of diversion during the period when the Southern Crossing extends from "shore to shore" only, and equal tolls are charged, is 33.42 per cent; and, with a 35-cent base toll on the San Mateo-Hayward Bridge and a 25-cent base toll on the Bay Bridge and the Southern Crossing, is 42.2 per cent. The weighted average rate of diversion of trucks is computed at 45.3 per cent in both cases.

In the estimates of diversions from San Mateo-Hayward Bridge all of such diversions are believed accounted for by the formula because the margins in favor of one crossing or the other are so pronounced, in all cases where there is a substantial movement of traffic, as to minimize the borderline cases.

There is a possibility that the San Mateo-Alameda bonds may be paid off from the revenues of the San Mateo and the Dumbarton Bridges by 1962, in which event these bridges might become free of tolls. This is not a certainty since decision may be made to retain the tolls to finance widening of either or both of these bridges. However, we have computed the adverse effect that the removal of tolls on the San Mateo Bridge would have on the volume of traffic diverted to the Southern Crossing. The results are shown at a subsequent point in this report.

Induced Traffic

Any new facility may be expected to stimulate traffic to some extent, the extent depending primarily on the desire to travel and the character of the new facilities which will make such travel easier or more convenient. The present crowded condition of the Bay Bridge and the growing congestion on San Mateo Bridge are important factors. In this instance we have examined the traffic flow between areas on both sides of the Bay which appear to be best served by the Southern

Crossing, and particularly those wherein the advantages in either time or distance offered by the Southern Crossing as compared with the use of either the Bay Bridge or San Mateo-Hayward Bridge are estimated to divert practically all of the traffic.

As to Bay Bridge traffic, such movements are those using common points 16, 32 and 34 in the East Bay Area. Common point 16 serves the area north and east of Hegenberger Road. Point 32 serves Alameda except the Naval Air Station and the strip along the Estuary. Point 34 serves Bay Farm Island and the Oakland Airport. This whole area is susceptible of substantial growth and extensive housing programs are already under way although the present population served is small.

The weighted average time saving for passenger vehicles to and from these areas is 3.7 minutes. The estimated average daily passenger vehicles moving through these points at the 1954 level diverted to the Southern Crossing is 6,498 out of a total of 9,860 estimated as diverted to the Southern Crossing and a total of 73,910 on the Bay Bridge.

The Bay Bridge, when built, induced new traffic of approximately 60 per cent, with an average time saving of 25 minutes. If in the same ratio for the 3.7 minutes, the induced traffic would amount to nine per cent of the 6,498 trips, or 585 a day.

Similarly, in the case of San Mateo-Hayward Bridge, all of the point-to-point movements through points 23, 25, 27, 29, 31, 37, 49 and 59 and portions through points 33, 39, 41, 43, 45 and 47 are allocated to the Southern Crossing. This accounts for 2,418 average daily passenger cars with a weighted average saving of 11.6 minutes per trip. By the same method as used for the Bay Bridge the indicated induced traffic would be 27.8 per cent of 2,418 or 676. The 2,418 daily trips identified above compare with estimated passenger vehicle diversions to the Southern Crossing from San Mateo Bridge of 2,446, and the 1954 average on the Bridge of 6,801.

The total induced traffic, therefore, is in terms of an average day:

From passenger vehicles diverted from Bay Bridge	585
From passenger vehicles diverted from San Mateo Bridge	672
	1,257

as compared with total diverted passenger vehicles of 9,860 from the Bay Bridge and 2,446 from San Mateo Bridge; a total of 12,306 average daily trips. The induced traffic is, therefore, 10.2 per cent of the diverted traffic. There are, however, other factors to be taken into consideration such as the possible stimulation of automobile traffic that may have been discouraged because of the congestion on the Bay Bridge. For these reasons we believe a reasonable estimate of induced traffic to be 10 per cent of the diverted traffic. This volume is not to be expected until such time as the approaches are substantially complete.

TRAFFIC ALLOCATED TO THE SOUTHERN CROSSING

In our report on this subject dated December 1, 1955, we considered three cases, viz:

Case I	Transbay Crossing from 3rd and Army Streets in San Francisco to the Bay Farm Island Bridge and including the Webster Street Tube and Ramps; as shown on Figure IX-1. This is analyzed on the basis of a base 25-cent toll.
Case II	As above but with the addition of the Embarcadero Freeway connection (except Howard and Mission Street Ramps) and the Fourth Street connection on the San Francisco side and the Alameda approach including a connection from the South Shore Freeway to Webster Street Tube; as shown on Figure IX-2. This is analyzed on the basis of a base 30-cent toll.
Case III	Crossing and Approaches complete as provided by applicable statutes as shown on Figure IX-3. This is analyzed on the basis of a base 35-cent toll.

In the present instance we are considering only Cases I and III. The conditions as to approaches in Case I are identical with those previously described. The approaches in Case III are as determined by the amendments to the statutes applicable to the Crossing enacted in 1955 and 1956 and as described in a previous section of this report. For convenience we are adhering to the numbering of the Cases and the tables that was used in our report of December 1955 although this may in certain instances result in breaks in the sequence.

CASE I - "SHORE TO SHORE"; 25-CENT BASE TOLL

Allocated from Bay Bridge 1955 Level

The traffic that would have been allocated in the year 1955 from the Bay Bridge at a 25-cent base toll is estimated as follows:

Bay Bridge Traffic	Revenue Vehicles (1,000)	Per Cent Diverted	Southern Crossing (1,000)
Passenger vehicles	28,095	7.7	2,163.3
Trucks	2,761	13.7	378.3
Buses	386	14.5	56.0*
Total	31,242		2,597.6

* Includes only the buses on Key System Routes O & W serving Alameda and R, the Hayward Line.

The vehicles allocated to the Southern Crossing from the Bay Bridge are traveling between areas growing at a much faster rate than the average of all the areas served by the Bay Bridge. An analysis of the areas and population projections presented later in this report indicates that a reasonable rate of projection is five per cent per year.

Traffic on Southern Crossing from Bay Bridge for July-December, Inclusive, 1961

On that basis the 1955 estimates above preceding are increased at the rate of five per cent per year and the estimate for July-December 1961 becomes:

	Vehicles (1,000)	Average Toll (2)	Toll Revenue (1,000)
Passenger vehicles	1,487	.245	$364.32
Trucks	254	.925	234.95
Buses (1)	28	.531	14.87
Total	1,769		$614.13

(1) Buses are assumed to remain constant.
(2) Average tolls as of 1955, including average toll on Key buses.

Allocated from San Mateo-Hayward Bridge, 1955 Level

The traffic that would have been allocated in the year 1955 from the San Mateo Bridge on a "Shore-to-shore" basis, with a 35-cent toll on the San Mateo Bridge and a 25-cent toll on the Southern Crossing, is shown by the following computation.

San Mateo Bridge Traffic	Vehicles (1,000)	Per Cent Diverted	Southern Crossing (1,000)
Passenger vehicles	2,607	42.2	1,100.2
Trucks	285	45.3	129.1
Buses	3	0.0	0.0
Total	2,895		1,229.3

We have previously stated that the current rate of increase on the San Mateo Bridge is about eight per cent per year, and that the rate of increase of traffic diverted from the Bay Bridge to the Southern Crossing is five per cent per year. The annual rate of increase on the San Mateo Bridge has been taken at six per cent through 1962.

Traffic on Southern Crossing from San Mateo Bridge, July-December, Inclusive, 1961

On that basis the 1955 estimates above are increased at the rate of six per cent per year and the estimate for the six-month period, July-December 1961 becomes:

	Vehicles (1,000)	Average Toll	Toll Revenue (1,000)
Passenger vehicles	781	$0.245 (1)	$191.3
Trucks	92	0.925	85.1
Total	873		$276.4

(1) This is the average passenger car toll on the Bay Bridge. It is assumed that the same average would apply to the Southern Crossing.

Summary Case I - 25-Cent Base Toll for 1961 and 1962

The foregoing figures are summarized on Table VIII-4, in which the estimated traffic and revenues of the Bay Bridge and the Southern Crossing are combined for the years 1961 and 1962. The forward projections from these years are based on the same facilities as defined under Case I with no additional approaches.

CASE III - ALL APPROACHES COMPLETED

In this case the Southern Crossing and the approaches defined by the applicable statutes are assumed to be completed by July 1, 1962, but the Crossing completed to the extent defined in Case I is assumed to have been carrying vehicles since July 1, 1961. For reasons which will appear later, the base toll for passenger vehicles in this case is taken at 35 cents both on the Bay Bridge and on the Southern Crossing. The diversions from the Bay Bridge were computed on the same basis as described in Case I except that the number of passenger vehicles on the Bay Bridge was assumed to be reduced by 10 per cent because of the 10-cent increase in base toll. There are insufficient data to make a precise estimate of the effect of this increase in toll. A decrease of 10 cents in passenger car toll rates on Golden Gate Bridge from 40 to 30 cents early in 1955 appears to have resulted in an increase of passenger car traffic of about nine per cent, and a subsequent decrease to 25 cents on September 30, 1955 has resulted in a still further increase in passenger car traffic but a loss in revenue. Increases in passenger car rates on the West Virginia Turnpike aggregating about 20 per cent appear to have resulted in a loss of traffic of about 10 per cent on short trips and no loss on long trips. On the other hand, two successive increases in toll rates on the Maine Turnpike, aggregating 50 per cent, seem to have had almost negligible adverse results. We believe that a 10 per cent reduction is a reasonable estimate of the effect on transbay passenger car traffic of a 10-cent increase in passenger car toll rates. Truck toll rates are assumed to remain at present levels.

The diversions from the Bay Bridge at 1955 level were taken at 7.7 per cent of passenger cars as in Case I for the year 1961 on a "shore-to-shore" basis. The diversions of passenger cars for projection to 1962 were taken at 13.35 per cent. The 1955 figures in either case were increased over 1961 and 1962, respectively, at an annual growth rate of five per cent.

In the case of diversions from San Mateo-Hayward Bridge; with a 35-cent base toll on both crossings the diversions to the Southern Crossing are somewhat lower than with a 10-cent advantage. These diversion rates applying to 1955 passenger vehicles are 33.42 per cent for 1961 and, with the approaches completed, are 36 per cent for 1962. The diversions computed at the 1955 levels are raised to the 1961 and 1962 levels, respectively, by applying an annual growth factor of six per cent.

Summary of Case III

The results of these calculations both as to diversions from the Bay Bridge and from San Mateo-Hayward Bridge and the projections for the years 1961-1963 are shown on Table VIII-6. The figures shown on the last named table are those used for the future projection of the combined traffic and revenues on the Bay Bridge and the Southern Crossing.

FUTURE PROJECTION OF TRAFFIC

The rate at which traffic on the Bay Bridge and Southern Crossing may be expected to grow is dependent, in part, on population increase, on increase in motor vehicle registration and in fuel consumption, the last named indicating the use of motor vehicles. It is also affected by the intensity of business activity and the areas in which these activities occur.

The statistics as to the population of the five counties in the Bay Area most closely related to the Southern Crossing and the population of the State of California are shown in Table VIII-7. The increases in the population of cities within these counties are shown on the same statement.

From an examination of this table it will be observed that the total population of the Bay Counties increased according to the United States Census 51 per cent in the decade between 1940 and 1950, reflecting in large part the effect of the activities stimulated by World War II. To 1954 the population has continued to increase by an amount of 11.5 for the four years. The projected population to 1960 indicates an increase over 1954 of 15.9 per cent and the projection to 1990 indicates for the succeeding decades 15.9 per cent, 14.9 per cent and 13.3 per cent, respectively.

The most pronounced increases have occurred and are expected to continue to occur in Contra Costa, San Mateo and Marin Counties. Population growth in Alameda and San Mateo Counties will have the greatest influence on the volume of traffic on the Southern

Crossing. On the basis of the future projections Alameda County will increase from 838,900 in 1954 to 1,510,000 in 1990, an increase of 80 per cent; and San Mateo County in the same period, from 321,900 to 620,000, an increase of 93 per cent.

As to the population of the cities, the greatest increases of past population are shown for Richmond, El Cerrito and Alameda. The increase in Alameda is the one which will have the greatest influence on the Southern Crossing.

Various indexes of business activity are shown in Table VIII-8. These indicate that the Bay Area during 1955 is in a prosperous condition.

The rates of growth of population, motor vehicle registration and gasoline consumption are shown by Table VIII-9. These data are also shown graphically in Figure VIII-5. The annual increase in motor fuel consumption in California has been: 1936-1955, 6.0 per cent; 1946-1955, 9.0 per cent.

Trend on the Bay Bridge

An examination of the trend of traffic on the Bay Bridge both over the long term and during recent years indicates a continuous upward trend broken only in 1954 by a slight reduction but resumed again in 1955. The trend in recent years has been affected by the fact that the Bridge has been congested and is already operating in excess of a comfortable operating capacity.

Over the period from 1941 to 1951 the average annual increase was at the rate of 4.5 per cent. Over the period 1941 to 1955 it was 3.8 per cent; from 1946, the year following the end of the war, until 1955 it was 2.7 per cent; from 1951 through 1955 it is 2.4 per cent. The change in the method of operating the lower deck, whereby it is open to passenger vehicles westbound during the morning peak and eastbound during the evening peak, has resulted in relieving the Bridge of a substantial amount of peak-hour congestion. Therefore, in our judgment the Bay Bridge will continue to show some increase in traffic beyond the present. For the year 1956 we have estimated a continuance of the rate of 2.4 per cent. From 1956 through 1975 we have estimated the annual rate of increase at 2.25 per cent. The actual traffic in 1955 amounted to 31,242,000 revenue vehicles and the number carried in the first six months of 1956 is 4.37 per cent greater than that carried in the corresponding period of 1955.

Trend on the San Mateo-Hayward Bridge

The rate of growth on the San Mateo-Hayward Bridge has been very rapid as shown by Table VIII-3. Following the acquisition of this Bridge by the State in September 1951 and the reduction in passenger car tolls to 35 cents the growth over the preceding year was in 1952, 1953, 1954 and 1955, 16.8, 14.5, 8.9 and 4.8 per cent, respectively. The rate of increase in the first six months of 1956 over the corresponding period of 1955 is 10.82 per cent.

For these reasons we estimate that the San Mateo-Hayward Bridge will continue to show a rate of increase in the order of six per cent per year until the Southern Crossing is completed and in operation.

Trend on Southern Crossing

In our opinion, the Southern Crossing will partake more of the characteristics of the San Mateo Bridge than those of the Bay Bridge, since approximately one third of its initial traffic is drawn from the San Mateo Bridge and since the traffic diverted from the Bay Bridge is that which is moving to and from the more rapidly growing communities in the Bay Area. We believe it is reasonable to expect an equal rate of increase on the Southern Crossing starting with six per cent per year for the first four years and continuing at lower rates in subsequent years as shown in Table VIII-12. This is supported by an analysis of the zones best served by the Southern Crossing as to present density of population, available area and probable future growth.

Projection of Traffic on the Bay Bridge 1955-1962

It has been estimated that the Transbay section of the Southern Crossing between Third and Army Streets in San Francisco and the Bay Farm Island Bridge in Alameda and the Webster Street tube under the Oakland Estuary can be completed and available for operation by July 1, 1961 and that all of approaches can be completed by July 1, 1962. On that basis the Crossing would be in limited use during July-December, incl., 1961, and to June 30, 1962 and in full use after July 1, 1962.

This is on the assumption that this project can be financed in time to commence construction early in 1957.

During the construction period, the net earnings of the Bay Bridge after deduction of operating and maintenance expenses are available as a contribution toward the financing of the Southern Crossing.

The projection of the vehicles, the toll revenue, the Bridge Railway revenue and the total toll revenue for this iterim period are shown on Table VIII-10.

The Bridge Railway income is unpredictable but is taken at $100,000 per year which is approximately the present rate.

The earnings that will accrue for the benefit of the new bond issue are shown in Table VIII-11. This income includes interest on funds in the reserve and income from concessions and rents at their present rate.

On that basis, the net earnings from January 1, 1957 to June 30, 1961 are $40,505,000; and, exclusive of interest on the Bay Bridge reserve, amount to $38,984,000. This reserve currently amounts to $15,000,000, having been reduced from $25,000,000 on December 1, 1955.

PROJECTION OF TRAFFIC AND REVENUE TO 1997

The future traffic and revenue which is estimated to accrue to this project under both Cases I and III, as previously defined, are projected as follows:

Case I - 25-Cent Toll

The development of the basic traffic for 1961 and 1962 is shown on Table VIII-4.

The table shows the diversions to the Southern Crossing from both the Bay Bridge and the San Mateo Bridge, also the vehicles remaining on each facility, the toll rates applicable, and the toll revenues of the Bay Bridge and Southern Crossing combined.

Since the Southern Crossing is assumed to be open to traffic by July 1, 1961, the first half of 1961 will include the results of the Bay Bridge only, and in the last half, for both facilities combined. The allowance for induced traffic is scaled down from the 10 per cent of the diverted traffic because of the newness of the facility. For the same reason no allowance is made during the first year for borderline cases.

In 1961 the estimated traffic on the Bay Bridge from Table VIII-4 is 33,894,000 vehicles and the corresponding toll revenue $10,526,000; and the traffic on the Southern Crossing for the last half of the year is estimated at 2,792,000 vehicles with the corresponding toll revenue of $941,000; a total of 36,686,000 vehicles and $11,467,000.

In 1962, in addition to the normal increases due to growth, the induced traffic has been increased to 10 per cent of the traffic diverted to the Southern Crossing and 10 per cent of the passenger vehicles diverted from the existing Bay Bridge has been added for borderline cases. These two items amount to 850,000 vehicles in round numbers. Reference to the maps, Figures VIII-4 and VIII-4A will make clear the importance of the approaches in inducing new traffic.

In 1962 the estimated traffic remaining on the Bay Bridge is 32,445,000 vehicles and the corresponding revenue $10,012,000; and on the Southern Crossing 6,410,000 vehicles and the corresponding revenue of $2,130,000; a total of 38,855,000 vehicles and $12,142,000.

Beginning with 1962 the vehicles and corresponding revenues, both on the existing Bay Bridge and on the Southern Crossing, are projected up to the year 1997 and are shown on Table VIII-12.

For purposes of applying the proper annual rates of increase we have computed the Bay Bridge vehicles shown in column 2 in a continuous progression although in 1968 the capacity of the Bay Bridge, as presently operated, will be reached and vehicles in excess of 37,000,000 will be obliged to use the Southern Crossing or San Mateo or Dumbarton Bridges.

Similarly the vehicles, shown in column 8, as diverted to the Southern Crossing because of its advantages will continue to increase at the rates of growth applicable thereto. After the Bay Bridge has reached capacity, vehicles in excess thereof will use the Southern Crossing and will increase the volumes shown in column 8. The estimated distribution of vehicles between the two crossings, year by year after taking account of capacity limitation is shown by Table VIII- 20.

At the beginning, in 1962 the Southern Crossing will carry only 16.5 per cent of the total vehicles crossing. By 1967 just as the Bay Bridge is reaching capacity the traffic on the Southern Crossing will have increased to the point where it will be carrying 18.8 per cent; and by 1970 when appreciable additional diversions from the Bay Bridge occur because of capacity limitation on the latter the ratio is 23.7 per cent; and will increase percentagewise rapidly beyond that period so that by 1975 it will be 32.9 per cent; by 1980 40.2 per cent; by 1985 46.0 per cent and in 1987, when it is assumed that both facilities will have reached their combined capacity, (70,000,000 vehicles a year) the Southern Crossing will be carrying 47.1 per cent of the total. The relative volumes of traffic on the two facilities year by year are shown by Table 20.

Based on the experience of tunnels in other parts of the country, by 1975 the Southern Crossing will have reached the comfortable capacity for two tubes and thereafter the use of three tubes will be continuous except possibly during the night hours. By 1987 it will have reached the capacity even of the three tubes.

For reasons shown hereinafter the ultimate annual capacity of the Bridge as presently constituted is taken at 37,000,000 vehicles and the Southern Crossing at 33,000,000 vehicles. Table VIII-12 shows the Projected combined revenues of both facilities including income of the Bridge Railway and income from rents of concessions the estimated maintenance and operating expenses, the estimated cost of insurance and expenses of fiduciary agents and the resulting net earnings from operations. This assumes that the lower deck of the Bay Bridge remains in its present condition and that the Bridge Railway continues to operate. The capacity of the Bay Bridge can be increased by removal of the Bridge Railway and substitution of a deck which can carry two additional lanes of vehicular traffic. There are no funds provided for such a project nor is it possible at this time to determine whether or not the Bridge Railway is to be continued. Although the figures are shown for each year from 1961 to 1997, it is not intended that such figures shall constitute predictions of the results for any specific year but that they shall represent the trend based on past experience and present knowledge of anticipated future developments.

The insurance cost for 1961 is primarily that on the Bay Bridge, as the premiums for that year on the Southern Crossing are capitalized.

Case III - 35-Cent Toll

In Case III the entire project is assumed to be completed with all approaches by July 1, 1962. Vehicles will be using the crossing beginning with July 1, 1961, but not at full volume until July 1, 1962, and 1963 will be the first calendar year after completion of the project. The available traffic on both the Bay Bridge and on the Southern Crossing for the years 1961, 1962 and 1963 was developed as shown on Table VIII-6.

Because of the 35-cent toll, due allowance has been made, as previously described, for the effect on the volume of passenger car traffic. A moderate allowance for induced traffic has been made in 1961 (less than the 10 per cent of diverted traffic) because of the newness of the facility. The number of vehicles estimated as remaining on the Bay Bridge in 1961 is 30,822,000 and the corresponding revenue $12,527,000; and the vehicles on the Southern Crossing 2,492,000 with corresponding revenue of $1,084,000; a total on both facilities of 33,314,000 vehicles and revenue of $13,611,000.

In 1962, with all of the approaches completed, allowance for induced traffic has been made at 10 per cent of the vehicles diverted to the Southern Crossing; and allowance for borderline cases amounting to 10 per cent of passenger automobiles.

The vehicles remaining on the Bay Bridge in 1962 are estimated as 28,521,000 and the corresponding revenue, $11,595,000; the vehicles on the Southern Crossing 6,711,000 with corresponding revenue of $2,799,000; amounting to a total on both crossings in 1962 of 35,232,000 vehicles and revenue of $14,394,000.

In 1963 the estimated vehicles remaining on the Bay Bridge are 27,808,000 and the corresponding revenue $11,378,000; the vehicles on the Southern Crossing 8,531,000 with corresponding revenue of $3,465,000; amounting to a total on both crossings in 1963 of 36,339,000 vehicles and revenue of $14,843,000.

Beginning with July 1, 1962, the vehicles and corresponding revenues on the Bay Bridge and on the Southern Crossing are projected for the conditions of Case III to 1997 as shown on Table VIII-14.

As described before in connection with Case I the projection of vehicles on the Bay Bridge in column 2 and of the Southern Crossing in column 8 is carried out to preserve the appropriate rate of increase in each category. The capacity of the Bay Bridge is reached, according to this projection, in 1976 and thereafter all vehicles in excess of 37,000,000 will be diverted to the

Southern Crossing until it too reaches its capacity in 1988. The number of vehicles carried by each crossing is shown in Table VIII-20.

Under the conditions as projected above, in 1963, the first full calendar year after the completion of the project, the Southern Crossing will carry 23.5 per cent of the total vehicles; in 1970 - 27.4 per cent; in 1976 - (when the Bay Bridge has reached its capacity) 29.6 per cent; increasing thereafter in 1980 to 36.4 per cent; in 1988, when both facilities have reached their ultimate capacity - 47.1 per cent.

The same allowances as in Case I have been made for revenues from the Bridge Railway and operating and maintenance expenses and insurance and fiduciary expenses. The resulting net from operations for each of the years in this period is shown in the last column of Table 14.

These projections are based on past experience and present indications, and are subject to the same qualifications as stated for the projections in Case I.

MAINTENANCE AND OPERATING EXPENSES

The maintenance and operating expenses on the Bay Bridge, which will be the only facility in operation from 1955 through the first half of 1961, are estimated on the basis of the San Francisco-Oakland Bay Bridge budgeted cost for the fiscal year ending June 30, 1956. The payroll items have been increased from year to year at the annual rate of three per cent, which study of past costs indicates to be a reasonable expectation of the future increases in payroll, exclusive of any additions in personnel. The payroll, including pension and retirement allowances and compensation insurance represents approximately 76 per cent of the total operating expenses of the Bay Bridge.

Beginning on July 1, 1961 the expenses for the Southern Crossing are added. The estimated operating and maintenance expenses for both facilities combined are shown for Cases I and III on tables 12 and 14, respectively.

In 1962, the first full year of operation under Case I of the Southern Crossing, it is estimated that the total maintenance and operating expenses of both facilities will be $3,111,000.

As traffic increases on the Southern Crossing additional staff will be added particularly in the form of toll collectors and additional charges will be incurred for power with increased use of the tubes. By 1967, the estimated maintenance and operating expenses are: Bay Bridge $2,495,000, Southern Crossing $1,142,000; total $3,637,000.

The maintenance and operating expenses as computed for five-year intervals are as follows:

Year	Bay Bridge	Southern Crossing	Total
1970	$2,675,000	$1,312,000	$3,987,000
1975	2,975,000	1,715,000	4,690,000
1980	3,250,000	2,170,000	5,420,000
1985	3,500,000	2,738,000	6,238,000
1990	3,750,000	3,162,000	6,912,000

The estimated maintenance and operating expenses for both facilities are shown for Cases I and III on Tables VIII-12 and VIII-14; and the projections, including insurance, are shown graphically on Figure VIII-3.

INSURANCE

Bay Bridge

The present insurance on the Bay Bridge is as follows:

Primary Physical Damage, All Risks	$26,331,135
Excess Coverage over $40,000,000 loss	8,667,000
Toll Plaza and Distribution Structure	2,500,000
Total	$37,498,135
The annual cost on the basis of payment of three-year premiums is approximately	140,000
In addition, Use and Occupancy Insurance is carried in amount of $4,000,000 at an annual rate of	14,000
Making the annual cost of insurance premiums	$ 154,000

The same group of Insurance Underwriters who handle the placing of insurance on the Bay Bridge have stated that All Risks Insurance in amount of $50,000,000 will be obtainable on the Southern Crossing, although the exact amount and the rate cannot be determined until the Rating Bureau has examined the plans. In our opinion, the amount is adequate. The usual terms of deductibles for earthquake damage and for damage from more usual causes will apply.

Use and Occupancy Insurance also will be required in amount sufficient to cover two-years' interest requirements.

At the same rates as are applicable to the Bay Bridge the annual premiums of the All Risks Insurance would be	$187,500
And the Use and Occupancy Insurance, in addition to that carried on the Bay Bridge, would be for Case I, where the additional coverage would be for $11,300,000 ($15,300,000-$4,000,000) at an annual cost of	39,600
Making the total cost in addition to the Bay Bridge	$227,100
Adding the present premiums on the Bay Bridge of	154,000
Making the total annual premiums on both facilities	$381,100
Because the underwriters expect to obtain a rate slightly less than on the Bay Bridge we have rounded this figure to	$350,000

In Case III where the two-year interest charge at 4.25 per cent amounts to $19,550,000 the Use and Occupancy insurance premiums will be greater in Case I by $14,700 and we have estimated the total annual insurance premiums under these conditions at $365,000

Fiduciary Agent's Expenses

We estimate the payments to the various trustees, transfer agents and paying agents at a total of $50,000 per year.

ESTIMATED EFFECT OF ELIMINATING TOLLS ON SAN MATEO-HAYWARD BRIDGE

It has already been stated that at the present rate of increase of toll revenues on the San Mateo and Dumbarton bridges the bonds secured by the revenues of these bridges may be paid off by 1962. In order to measure the effect of the removal of the tolls on the San Mateo Bridge, an estimate was made of the number of vehicles that would be diverted from San Mateo Bridge if free of tolls, to the Southern Crossing in 1962, both for Case I, at a base 25-cent toll, and for Case III at a base 35-cent toll. The principles were identical with those previously described as used in estimating the diversions that would occur from San Mateo Bridge at the present toll rate on the latter of $0.35. The results indicated the following:

Case I - Reduction in diversions at the 1962 level

1,056,000 passenger cars at the average toll of $0.245	= $258,700
128,000 trucks at the average toll of $0.925	= 118,400
Total	$377,100

It has been shown on Table VIII-12 that the estimated toll revenue to Bay Bridge and Southern Crossing combined, in the calendar year 1962, was $12,142,000. Reducing this by $377,100 would leave the revenue, with San Mateo Bridge toll free, $11,765,000 - a reduction of 3.1 per cent.

Case III - Reduction in diversions at the 1962 level

883,000 passenger cars at the average toll of $0.345	= $304,600
118,000 trucks at the average toll of $0.93	= 109,700
Total	$414,300

It has been shown in Table VIII-14 that the estimated toll revenues in Case III at a base 35-cent toll were, for the year 1962, $14,394,000. Subtracting from this amount the above estimated reductions leaves a net of $13,980,000. The estimated reduction of $414,000 in toll revenues is 2.9 per cent of the estimated toll revenues in Case III based on San Mateo Bridge toll rates at their present levels.

In 1955 the San Mateo Bridge carried 2,895,000 vehicles. The increase during the first six months of 1956 over the corresponding period last year is 10.8 per cent; and if this rate continues, the traffic for 1956 will be approximately 3,200,000 vehicles. The comfortable capacity for a two-lane bridge for the length of the San Mateo-Hayward Bridge is not far from 4,000,000 vehicles a year. This rate of capacity has been exceeded in the case of the Posey Tube between Oakland and Alameda and in the case of the Sumner Tunnel in Boston, both being two-lane facilities which carry vehicles at the rate of between 11 and 12 million a year. It should be observed, however, that both of these latter facilities, as well as being seriously congested at peak hours, are short; whereas the San Mateo Bridge is over seven miles long. We have projected the traffic of San Mateo Bridge in the year 1962, before allowing for any diversions of vehicles to the Southern Crossing, at 4,400,000. After allowing for diversions of 1,076,000 vehicles to the Southern Crossing from a free San Mateo Bridge, there would remain thereon 3,326,000 vehicles. At an annual rate of growth of six per cent, the practical capacity would be reached within the next four or five succeeding years. It is, therefore, probable that even if the tolls were to be removed from San Mateo Bridge, the maximum effect of such removal would be in the amount indicated above for the first year or two after removal of tolls, and that the effect would diminish as the number of vehicles on San Mateo Bridge increased. Increasing congestion would cause a higher rate of diversion to the Southern Crossing.

It is by no means certain that the San Mateo-Hayward and the Dumbarton Bridges will be freed of tolls. It is possible that it may be decided either to increase the capacity of one or both of these bridges or to improve the approaches and finance the same by toll revenues. In such case the conditions as to competition with the Southern Crossing would be the same as have been set forth in this report.

EFFECT OF THE POSSIBLE CONSTRUCTION OF A RAPID TRANSIT SYSTEM WITH A TRANSBAY SUB-AQUEOUS TUBE

In estimating the possible effect of the construction of a rapid transit system in the Bay area and the number of passengers that it would divert from the use of the Bay Bridge and vehicular means of transportation, we have taken into consideration the same zone-to-zone distribution of passenger vehicles now using the Bay Bridge as was determined by the engineers for the Bay Area Rapid Transit Commission who estimated the traffic on the Rapid Transit System.

The report of the Engineers above referred to, dated January 5, 1956, shows the proposed location of the optimum system with its stations. On the San Francisco side, we estimated that all passengers originating or terminating within one-half mile of the station could be considered as potential to the Rapid Transit System and on the East side of the Bay in the cities of Berkeley, and Oakland, the same one-half mile distances were used as measuring the potential, but in the outlying areas a wider range was used because of the belief that some of the passengers at least would use their automobiles for obtaining access to the Rapid Transit station and in such case the influence of the Rapid Transit System would extend well beyond the one-half mile limit. Experience with Rapid Transit Systems in other cities such as Boston, Chicago, and New York indicates that the influence of the Rapid Transit System generally is limited to a quarter mile walk.

In estimating the effect of the Rapid Transit System, we distinguish between the diversions at peak and at other than peak hours.

We computed the relative time and distance and cost of travel between the various rapid transit stations by use of the Rapid Transit System and by automobile. For this purpose we took the rapid transit fare of 40 cents as shown in the Engineer's report above referred to. For cost of motor vehicle travel by way of the Bay Bridge we added to the 25-cent passenger car toll the cost of use of the vehicle at 3 cents a mile and a 50-cent parking charge. We assumed the number of passengers per automobile at 1.87 as indicated by the most recent peak-hour counts on the Bay Bridge. The range of differences in time in transbay movements by way of rapid transit or by way of automobile was from a gain of 6.5 minutes by use of the Rapid Transit in a trip between California Station and/or Powell Street Station and Pine Street, Oakland, and a loss of 10.4 minutes in a trip between California Street Station or Powell Street Station in San Francisco to El Cerrito Station.

Measured by relative costs per person the range is 13 cents to 34 cents in favor of Rapid Transit. The greatest savings in cost are in the movements involving substantial mileage of automobile travel such as between California Street or Powell Street, San Francisco, to Walnut Creek (21.4 miles), San Leandro (17.2 miles), and Richmond (15.9 miles).

We estimated diversions based on our judgment as to how passengers would react to the choice of routes and to formalize this judgment constructed a set of diversion curves. For equal trip times by either facility at peak hours, we estimated that half the potential passengers would use each facility even though to do so would cost a patron of the bridge a 25-cent automobile toll or roughly 12.5 cents per passenger. At the same cost per passenger, but with a saving of 1.6 minutes by Rapid Transit, the diversions thereto would be 60 per cent; at a saving of 6.5 minutes 85 per cent; and diversions for intervening time savings proportional. At a seven minute disadvantage the diversions would be only five per cent.

Similarly at a cost differential of 20 cents in favor of Rapid Transit, 50 per cent diversion occurs at a saving by Rapid Transit of 0.75 minutes and an 85 per cent diversion at a saving of 5.75 minutes. On the other hand, at a time loss by Rapid Transit of 4.5 minutes but the same favorable cost differential, the diversions to Rapid Transit would be 25 per cent and at a time loss of 9.5 minutes, only five per cent. In other words, the effect of time is most important in estimating the diversions. Diversions at off-peak hours were taken at half the rate of those at peak hours.

The zone-to-zone movements analyzed by us accounted for 43,776 automobile crossings or 59 per cent of the average daily traffic on the bridge of 74,221 passenger vehicles. Of these, the peak hour represented 20.0 per cent and all other hours 39.0 per cent of the total crossings.

Of the total zone-to-zone movements in peak hours analyzed we found 22.6 per cent of the trips to be potential to the Rapid Transit and by applying the method described above we estimated that passengers on 46.7 per cent of these trips would be diverted thereto. For the zones not analyzed we took the potential at 25 per cent of the total trips and the diversions to the Rapid Transit at 50 per cent of the potential. A few San Francisco zones were not analyzed because obviously the traffic originating or terminating therein was not potential, and Treasure Island traffic was omitted as having no means of access to Rapid Transit.

At other than peak hours, our analysis indicated that in zones analyzed 28 per cent of the trips would be potential and of these we estimated that 25 per cent would be diverted; that is, the diversions in off-peak hours were taken at half the rate of those at peak hours. Passenger trips from the San Francisco zones not analyzed were classified as to potential and the same rates of diversion as those analyzed.

The net result was that out of the 1954 daily volume of 74,221 passenger car trips, 18,892 vehicles were estimated to be carrying passengers potential to the Rapid Transit, and passengers from 5,938 of these were estimated to be diverted thereto. This represents eight per cent of the total daily passenger movement.

The volume of passenger car traffic for the full year, 1954, was 27,091,000 for 365 days. The annual passengers carried by Rapid Transit are estimated at 300 times the average day. On this basis, the annual Rapid Transit traffic obtained by diversion from automobile is equivalent to 1,781,000 vehicles or 6.6 per cent of the total number of passenger vehicles crossing the Bay.

The estimated cost of the initial stage of the "Optimum Plan" is given by the Consulting Engineers as in excess of $700,000,000. Considering the need for legislation, both state and local, the delays accompanying final choice of routes through city streets, the acquisition of rights of way, preparation of plans and construction, as well as the magnitude of the financing, it is unlikely that such a system could be in operation before 1965 at the earliest.

Assuming that the optimum plan would be in operation at the beginning of 1965, then the application of the rates of diversion derived above would result as follows:

31,200,000 passenger cars estimated on the Bay Bridge at 6.6 per cent diverted=	2,060,000 cars
At an average toll of $0.245 this would result in a reduction in revenue of	$505,000
The Bay Bridge would lose also the revenue from the Key System facilities estimated at:	
Trains on Bridge Railway	100,000
Buses	100,000
A total reduction because of rapid transit competition, estimated at	$705,000

Carrying out the same method of calculations for Case III we have estimated that the reduction in revenue to the Bay Bridge and Southern Crossing with a passenger car toll at 35 cents in effect would be about $700,000 and with the $200,000 from Key System trains and buses would make the total loss about $900,000.

The number of rapid transit passengers corresponding to the 2,289,000 passenger vehicles is, at 1.87 passengers per vehicle, 4,290,000. The total number crossing the Bay by rapid transit, including the 10,000,000 now carried by the Key System, would be 14,290,000 a year, or at the rate of 47,600 a day.

CAPACITY

The ultimate annual capacities of the Bay Bridge and the Southern Crossing are estimated to be:

Bay Bridge	37,000,000 vehicles
Southern Crossing	33,000,000 vehicles
Total	70,000,000 vehicles

The precise number of vehicles will depend on percentage of commercial vehicles and on the hourly pattern of traffic flow. At the above volumes, both facilities will be extremely crowded, well beyond the so-called practical capacity.

Bay Bridge

The Bay Bridge is now carrying revenue vehicles in excess of 31 million a year which is well beyond the comfortable capacity. The traffic pattern is stabilized and varies little from month to month. The maximum days of each month in 1954 ranged from 90,000 to slightly more than 100,000. In 1953, during the Key System strike, the maximum daily traffic ranged from 105,000 to 109,000 vehicles.

The hourly pattern on the upper level of the Bay Bridge is shown in Figure VIII-6 and for the lower level in Figure VIII-7. The latter figure shows both commercial and passenger vehicles.

Taking Friday, January 14, 1955, as a typical day, the total number of passenger vehicles carried both on the upper and lower levels in the direction of maximum flow of traffic which occurred between five and six o'clock was 4,865 which is 6.03 per cent of the total number of passenger cars carried on that day. During the same period, the total number of vehicles of all classifications was 5,409, which is 5.93 per cent of the total number of vehicles, revenue and nonrevenue, carried on that day amounting to 91,236. These same relationships were shown for Monday, July 12, 1954.

Assuming the continuance of the same pattern, the passenger car volume for the year is approximately 6,000 times that of the busy hour in the direction of the maximum flow.

Taking the capacity of the upper level per hour in direction of maximum flow as 4,400 passenger vehicles and that of the lower level as 1,000 passenger vehicles in the same hour gives 5,400 vehicles in the busy hour in the direction of the maximum flow of traffic. This is equivalent to an annual volume of 32,400,000.

The capacity for trucks and buses on the lower level based on present practice is approximately 550 per hour which, multiplied by the ratio applicable to this class of traffic of 7,200, indicates an annual equivalent of 3,980,000 commercial vehicles making a total of both passenger and commercial vehicles of 36,380,000. The pattern on the Bay Bridge has become so stabilized that it is unlikely to depart to any great extent from the present. The ultimate annual capacity can be taken at 37,000,000 vehicles.

Southern Crossing

The hourly pattern on the San Mateo Bridge for a typical day is shown in Figure VIII-8 and indicates the total number of vehicles in the busy hour in the direction of maximum flow of traffic as 438 out of total traffic for that day of

6,915, or 6.33 per cent. The average daily traffic in 1954 was 7,571 and at the above ratio the maximum hourly traffic in the direction of maximum flow of traffic would amount to 6.33 per cent of this, or 480 vehicles. The total traffic for the year, 2,763,569 vehicles, is 5,760 times the hourly traffic.

The capacity of the Southern Crossing is limited by the tubes. Assuming that in the hour of maximum traffic four lanes would be open in one direction and that each lane would carry 1,400 vehicles per hour, the maximum capacity would be 5,600 times 5,760, or 32,256,000. The ultimate annual capacity of the Southern Crossing can be taken at 33,000,000.

At these volumes, both facilities will be so crowded that sustained operation will be difficult.

Capacity of Approaches

The analysis of the traffic on the approaches to be built as part of the Southern Crossing project indicates two critical sections: the Embarcadero Approach and the Webster Street Tube. The estimated traffic on the proposed Bay Farm Island and Alameda approaches is relatively light and congestion in the near future is unlikely.

On the Embarcadero Approach between the connection with the Southern Crossing at Army and Third Streets to the Embarcadero Freeway at Howard Street, the analysis indicates that, as of 1963 when the approach will be in use for the first full year, the heaviest density will occur between the Fourth Street ramp and the connection with the Southern Freeway at Army Street. The volume of traffic in 1963 estimated for each section of this approach moving in the south and eastbound direction in the evening peak hour is shown on Table VIII-18. The density between the Fourth Street and the Third Street ramp is about 3,750 vehicles, and between the Mariposa Street ramp and the connection with the Army Street Approach is about 3,400 vehicles. Of this traffic, only about 500 vehicles or about 14 per cent are estimated as using the Southern Crossing and the balance are nontoll-paying vehicles.

A projection of these traffic densities to 1975 indicates that in that year the total traffic on the same two sections will be upwards of 5,000 vehicles south and eastbound at the maximum hour and that of this traffic about 80 per cent will be nontoll-paying traffic. The Embarcadero Approach in these sections is a divided six-lane facility with three lanes open in either direction. A facility of this type with completely separated traffic should be able to carry on three lanes between 4,500 and 5,400 vehicles per hour; the latter figure being at or close to the ultimate capacity and involving serious congestion.

The section of the approach from Fourth Street north to the Embarcadero Freeway is a six-lane divided facility, three lanes in each direction. As of 1975 we estimate the traffic on the section between the Spear Street and Fourth Street ramps at about 3,282 vehicles southbound at the peak evening hour, of which slightly more than 80 per cent are nontoll-paying vehicles and only 20 per cent are bound for the Southern Crossing. The one section described is the only portion of the Embarcadero Approach which is likely to be critical.

The nontoll-paying traffic on these freeways is estimated on the basis of consideration of information provided by District IV, Division of Highways, and our studies of the data obtained from the origin and destination survey, previously referred to, made for the Bay Area Rapid Transit Commission.

As to the East Bay Approaches; these have ample capacity for many years, except as to the Webster Street Tube to which reference is made later.

As to the distribution of vehicles at the Bay Farm Island Interchange; for Case I, the movements to and from the west and north toward Alameda and Oakland represent 49.8 per cent of the vehicles crossing the Southern Crossing. The movements to and from the east to San Leandro Bay Freeway represent 50.2 per cent. In Case III, the movements to and from the west and north are 50.1 per cent and those to and from the east 49.9 per cent. These ratios apply to vehicles carried by the Southern Crossing up to the time that additional vehicles are diverted to it because of capacity limitation of the Bay Bridge. All of these additional movements are assumed to be moving to or from points in Alameda and Oakland or north thereof and will, therefore, increase the proportion of the total traffic moving in that direction. Such additional diversions are projected to commence for Case I in 1968, and for Case III in 1976.

Reference has already been made to the fact that the existing Bay Farm Island Bridge is a four-lane bascule span which is opened from time to time for the passing of sea-going vessels. If traffic develops in accordance with the projections in this report, the capacity of this bridge will be reached between 1975 and 1980 in Case I and somewhat later in Case III. Aside from interruptions to traffic caused by the opening of the bridge, the daily capacity could be taken at between 40,000 and 46,000.

The Alameda Approach is to consist of a connection from Bay Farm Island to a point on the southerly shore of the City of Alameda and a highway along the southerly shore of the City of Alameda from such point to a southerly prolongation of Eighth Street, thence northerly along Eighth Street to a point near Lincoln Avenue, thence along the Southern Pacific right of way to Atlantic Avenue, and thence to the Posey Tube connecting the City of Alameda and the City of Oakland and a parallel tube which shall be constructed as part of the approaches, with on- and off-ramps in both directions in the vicinity of the north end of the bridge connecting to Bay Farm Island, and with adequate on- and off-ramps connecting the freeway and tubes with the streets in the cities of Oakland and Alameda and an interchange in the vicinity of Atlantic Avenue and Webster Street in the City of Alameda.

This approach will be available to vehicles not using the Southern Crossing which will undoubtedly constitute the major part of its traffic.

Any local traffic developing between Bay Farm Island and points south and east thereof and Alameda and Oakland will reduce the capacity of these approaches available for vehicles to and from the Southern Crossing.

Of the Southern Crossing vehicles using the existing Bay Farm Island Bridge, the heaviest single movement is by way of the High Street Bridge and the junction of High Street with the Eastshore Freeway in Oakland.

As to vehicles to and from Oakland by way of the Tubes, the Webster Street Tube to be provided under the Estuary will be used in parallel with the existing Posey Tube thus providing two lanes in each direction; the Posey Tube north or eastbound, the Webster Street Tube south or westbound. Only approximately 10 to 13 per cent of the Southern Crossing traffic using the Bay Farm Island Bridge has origin or destination at points north of the Webster Street Tube. By 1975 to 1980, this volume is estimated at 1,500,000 vehicles in Case I, and somewhat less in Case III. Therefore, the Southern Crossing will not of itself impose a critical load on the Tubes for many years. Considering the present congested condition of the Posey Tube which is currently carrying vehicles at an annual rate of approximately 11 million, the new housing developments in progress in Alameda and Bay Farm Island, and the new traffic induced by the improved facilities, the nontoll-paying traffic on the Webster Street and Posey Tubes may well increase substantially. By 1975 the number of vehicles using the Webster Street and the Posey Tubes in conjunction with the Southern Crossing and including local movements may well reach an additional annual volume of five million and the number will continue to increase so long as capacity in the tubes is available.

The capacity of the San Leandro Bay Freeway should be ample for many years insofar as traffic to and from the Southern Crossing is concerned.

CONCLUSIONS

The following conclusions are subject to the assumption set forth on page 11 of this report and to the qualifications set forth in the traffic and earnings projections:

1. The projection of traffic and earnings that would accrue to the Southern Crossing and the Bay Bridge for Case I, including the transbay section of the Southern Crossing and the Webster Street Tube as shown on Figure IX-1, are set forth by Table VIII-12.

2. The traffic and earnings that will accrue to the Bay Bridge and the Southern Crossing combined with all of the approaches completed, as defined in the applicable statutes, are set forth for Case III in Tables VIII-14. This assumes a base toll of passenger vehicles on both facilities of 35 cents.

3. The projections are based on past experience and present indications as to the future. They are intended to represent a trend and not to be interpreted as predictions for any specific year.

4. We are of opinion that adequate insurance will be available for the Southern Crossing.

5. The ultimate capacities of the crossings are estimated at annual volumes of 37,000,000 vehicles of all classes on the Bay Bridge and 33,000,000 on the Southern Crossing (assuming that the tube lanes are so arranged as to permit the operation of four in one direction and two in the opposite direction when traffic so requires), an aggregate capacity for both facilities of 70,000,000 vehicles. At these volumes traffic congestion would be serious. The projections indicate that the ultimate capacity of both facilities will be reached about 1987.

6. An analysis of the volume of traffic that will be carried on the approaches defined by the applicable statutes indicates that the Embarcadero Freeway Approach in San Francisco will carry a large volume of traffic, particularly between the Fourth Street Ramp and the connection with the proposed Southern Freeway at Army and Third Street, unrelated to the use of the Southern Crossing. The volume of such traffic in 1963 is estimated at 86 per cent and in 1975 at 80 per cent of the grand total at peak hours.

7. The projections referred to above make no allowance for the effect of the possible freeing of the San Mateo Bridge from tolls and of the possible construction of a subaqueous rapid transit tube now under study by the Bay Area Rapid Transit Commission. In our opinion, the freeing of San Mateo Bridge will not affect the earnings on the Bay Bridge and Southern Crossing by more than a reduction of 3 per cent and that reduction will be offset by additional traffic within a period of approximately five years after such freeing of tolls. We estimate that the effect of the possible construction of a regional Rapid Transit System including a crossing of the bay by a subaqueous tube would not decrease the revenue of the Bay Bridge and Southern Crossing combined more than $700,000 or approximately 7 per cent of net earnings, in 1965, which is the earliest year that we consider such rapid transit competition could be introduced.

8. No allowance has been made for possible suspension of the Bridge Railway or for increased vehicular capacity by flooring over the space on the Bay Bridge now used by the Railway, since no funds are available and no provision has been made therefor.

SAN FRANCISCO-OAKLAND BAY BRIDGE

ANNUAL TRAFFIC AND TOLL REVENUE

SUMMARY

Year	Light Passenger Vehicles	Buses (Incl. Key System)	Trucks	Total Revenue Vehicles	Revenue	Average Toll $	Bridge Railway Revenue	Total Toll Revenue Vehicular and Railway
	(Figures stated in thousands)							
1936 (1)	1,291	7.8	28	1,327	$ 889	.6659		$ 893.5*
1937 (2) (3) (7)	8,605	95.3	312	9,013	4,884	.5362		4,884.4
1938	7,898	144.6	419	8,462	4,528	.5252		4,528.4
1939 (4) (8)	10,007	193.3	559	10,760	5,105	.4657	$495.0	5,600.5
1940 (5) (9)	14,058	256.2	713	15,027	4,696	.3076	460.6	5,156.4
1941 (6)	17,293	421.6	955	18,669	5,311	.2845	350.6	5,661.8
1942 (6)	17,401	644.1	1,129	19,175	5,740	.2928	408.5	6,148.8
1943 (6)	15,644	500.6	1,287	17,431	5,435	.3118	529.7	5,964.6
1944 (6)	14,711	515.0	1,398	16,624	5,384	.3239	594.8	5,978.9
1945 (6) (10)	17,790	546.8	1,460	19,798	6,270	.3167	631.2	6,901.3
1946	21,846	612.5	1,562	24,021	7,315	.3045	387.5	7,702.0
1947	22,823	556.0	1,790	25,170	7,676	.3050	297.6	7,973.1
1948	23,051	516.2	1,906	25,473	7,773	.3176	273.5	8,046.5
1949	24,113	440.4	2,035	26,589	8,087	.3041	242.7	8,329.7
1950	25,421	411.8	2,250	28,083	8,610	.3066	206.6	8,816.6
1951	26,181	448.7	2,477	29,106	9,044	.3107	179.2	9,223.2
1952	26,773	428.5	2,554	29,755	9,305	.3127	170.4	9,475.4
1953	27,532	405.6	2,575	30,513	9,546	.3129	115.3	9,661.3
1954	27,133	400.6	2,612	30,146	9,403	.3119	111.8	9,514.8
1955	28,095	385.7	2,761	31,242	9,770	.3090	102.0	9,872.0

* Includes extra passengers in automobiles as well as bus passengers.
Includes $4,295. Collectors cash overages unclassified.

(1) Bridge opened for vehicular traffic November 12, 1936.
(2) Key bus operation over Bridge started May 9, 1937.
(3) Berkeley Ferry operation suspended August 15, 1937.
(4) Bridge railway started operation January 15, 1939.
(5) Last transbay ferry suspended operation May 16, 1940.
(6) Gasoline rationing in effect as follows:
    4 gals. per month December 2, 1942
    3 gals. per month October 12, 1943
    2 gals. per month March 22, 1944
    End of rationing August 15, 1945
(7) Base tolls on Bridge reduced February 1, 1937.
(8) Base tolls on Bridge reduced June 24, 1939.
(9) Base tolls on Bridge reduced January 1, May 25 and July 1, 1940, the last to 25¢ per passenger automobile which is still in effect.
(10) Bridge railway toll rate reduced to $0.0175 November 5, 1945.

KEY SYSTEM PASSENGERS*- TRAIN AND BUS - SINCE OPENING OF BRIDGE RAILWAY JANUARY 15, 1939

BY YEARS 1939-1955, INCLUSIVE

Year	Trains					Buses				Total Revenue Passengers (Cols. 1+6)	Index Numbers 1939-1941 Average = 100	Total Passengers Including Toll Free (Cols. 4+8)
	Passengers					Passengers						
	Revenue	Toll Free (A)		Total (Cols. 1+2+3)	Toll Revenue	Revenue	Toll Free	Total	Toll Revenue			
		Yerba Buena	Transbay									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	(Figures stated in thousands)											
1939	19,800			19,800	$495	1,339(C)		1,339(C)	$ 33	21,139	101	21,139
1940	18,424			18,424	461	3,524		3,524	88	21,948	105	21,948
1941	14,023			14,023	351	5,803		5,803	145	19,826	95	19,826
1942	16,366			16,366	408	10,747		10,747	269	27,113	129	27,113
1943	21,397			21,397	530	7,598		7,598	190	28,995	138	28,995
1944	23,942			23,942	595	7,847		7,847	196	31,789	152	31,789
1945	26,469	10,815	49.8	37,334	631	8,457	5.2	8,462	211	34,926	167	45,796
1946	22,177	5,425	49.1	27,651	388	9,353	1.4	9,354	234	31,530	150	37,005
1947	17,015	1,551	5.0(B)	18,571	298	8,218	1.7	8,219	205	25,233	120	26,790
1948	15,631	1,207	5.8	16,844	274	7,736	1.1	7,737	193	23,367	111	24,581
1949	13,868	953	4.5	14,826	243	6,830	0.3	6,830	171	20,698	99	21,656
1950	11,812	1,050	6.4	12,868	207	6,479	1.2	6,480	162	18,291	87	19,348
1951	10,255	1,442	5.0	11,702	179	7,241	3.0	7,244	181	17,495	83	18,946
1952	9,757	1,786	4.7	11,548	170	6,736	4.6	6,740	168	16,493	79	18,288
1953	6,605(D)	1,219	10.6	7,834	115	4,609		4,609	115	11,214	53	12,443
1954	6,400	1,177	6.1	7,584	112	4,529		4,529	113	10,929	52	12,113
1955	5,836	841	6.7	6,684	102	4,136	3.3	4,139	103	9,972	48	10,823

* Includes Interurban and Sacramento Northern, 1939-1941, inclusive.

(A) U.S. Government - years prior to 1945 not included.
(B) Minus adjustment of 13,618 for train tickets previously sold U.S. Government agencies on which tolls subsequently collected.
(C) Approximately 1,410,177 Key Bus Passengers carried prior to January 15, 1939 not included.
(D) Strike of Key System employees July 24 to October 7, 1953.

Key System - Adult Fares - Transbay

Zone 1	Cash	Commutation		
		Unlimited	5-Day	20-Ride
July 1, 1928 - November 5, 1945	$0.21	$ 6.50		
November 5, 1945 - October 1, 1946	0.20	6.50		
October 1, 1946 - September 17, 1949	0.25	8.50		
March 1, 1947 - September 17, 1949				$4.50
January 1, 1948 - November 19, 1948		10.50	$9.50	
September 17, 1949 - August 10, 1952	0.30			5.40
August 10, 1952	0.35			6.50
November 30, 1953	0.50			8.00

Table VIII - 3

REVENUE VEHICLES CARRIED

Calendar Year	SAN MATEO-HAYWARD BRIDGE 1929 - 1955		DUMBARTON BRIDGE 1927 - 1955	
	Total Vehicles (Thousands)	Per Cent Increase Over Previous Year	Total Vehicles (Thousands)	Per Cent Increase Over Previous Year
1927(11-1/2 mos.)			378.4	
1928			419.5	
1929(10 mos.)	716.5		306.8	-26.9
1930	611.5		322.3	5.1
1931	633.0	3.5	332.4	3.1
1932	569.1	-10.1	290.9	-12.5
1933	455.0	-20.1	257.0	-11.6
1934	465.7	2.3	265.8	3.4
1935	494.8	6.3	282.0	6.1
1936(1)	530.5	7.2	282.7	0.2
1937	397.0	-25.2	238.1	-15.8
1938	351.5	-11.5	208.7	-12.4
1939	358.5	2.0	207.8	-0.5
1940	331.6	-7.5	196.0	-5.7
1941	362.6	9.4	209.4	6.9
1942(2)	372.3	2.7	188.6	-10.0
1943	412.1	10.7	194.2	3.0
1944	466.8	13.3	213.2	9.8
1945	704.5	50.9	293.8	37.8
1946	1,064.0	51.0	418.2	42.3
1947	1,306.6	22.8	467.8	11.9
1948	1,452.4	11.2	498.6	6.6
1949	1,561.2	7.5	582.4	16.8
1950	1,690.8	8.3	669.9	15.0
1951(3)	1,898.0	12.3	830.5(4)	24.0
1952	2,217.7	16.8	980.0	18.0
1953	2,538.5	14.5	1,141.0	16.4
1954	2,763.6	8.9	1,250.5	9.6
1955	2,895.1	4.8	1,360.4	8.8

(1) Bay Bridge opened November 12, 1936.

(2) Gasoline rationed December 4, 1942 to August 15, 1945.

(3) State of California took title.
September 1951 toll reduced from 50 cents to 35 cents.

(4) Estimated

Table VIII - 3-A

ANNUAL TRAFFIC AND TOLL REVENUE

Year	Light Passenger Vehicles	Buses	Trucks	Total Revenue Vehicles	Revenue	Average Toll
SAN MATEO-HAYWARD BRIDGE						
1952	2,002,045	2,569	213,085	2,217,699	$ 847,014	$0.382
1953	2,310,060	2,213	226,202	2,538,475	967,786	0.381
1954	2,505,561	2,658	255,350	2,763,569	1,092,775	0.395
1955	2,607,153	2,892	285,021	2,895,066	1,146,635	0.396
DUMBARTON BRIDGE						
1952	781,155	3,014	195,828	979,997	$ 508,992	$0.519
1953	959,420	3,192	178,344	1,140,956	555,267	0.487
1954	1,063,808	3,112	183,549	1,250,469	558,994	0.447
1955	1,126,993	3,193	230,194	1,360,380	640,253	0.471

CASE I - ESTIMATED TRAFFIC AND REVENUE OF SOUTHERN CROSSING - AT 25¢ BASE TOLL

1961-1962

Type of Vehicle	EXISTING BAY BRIDGE					SAN MATEO-HAYWARD BRIDGE					SOUTHERN CROSSING		
(1)	Before Diversions (2)	Diversions to Southern Crossing (3)	Balance Remaining (4)	Average Toll (5)	Toll Revenue (6)	Before Diversions (7)	Diversions (A) (8)	Balance Remaining (9)	Average Toll Remaining (10)	Toll Revenue Remaining (11)	Vehicles (12)	Average Toll (13)	Toll Revenue (14)
	(Figures stated in thousands)												
1 9 6 1 Transbay Section Estimated Completion Date July 1, 1961. 1961 Diversions Are for Last Six Months of Year.													
Passenger automobiles	32,108	1,487	30,621	$.245	$ 7,502	3,699	781	2,918	$.34	$ 992	2,268	$.245	$ 556
Trucks	3,155	254	2,901	.934	2,708	404	92	312	.92	287	346	.925	320
Buses	400	28	372	.849	316	3	0	3	.85	3	28	.531	15
Total	35,663	1,769	33,894		$10,526	4,106	873	3,233	.397	$1,282	2,642		$ 891
Induced traffic											150	.335	50
Total											2,792	.337	$ 941
1 9 6 2													
Passenger automobiles	32,830	3,123	29,707	.245	$ 7,278	3,921	1,655	2,266	.34	$ 770	4,778	$.245	$1,171
Trucks	3,226	532	2,694	.934	2,516	428	194	234	.92	215	726	.925	672
Buses	400	56	344	.849	292	3	0	3	.85	3	56	.531	30
Total	36,456	3,711	32,745	.308	10,086	4,352	1,849	2,503	.395	$ 988	5,560		$1,873
Induced traffic											550	.333	183
Borderline passenger automobiles transferred to Southern Crossing			-300	.245	-74						300	.245	74
Total			32,445	.309	$10,012						6,410	.332	$2,130

Note: (A) Base passenger vehicle on San Mateo-Hayward Bridge $0.35.

SUMMARY - SOUTHERN CROSSING AND EXISTING BAY BRIDGE COMBINED

	Vehicles	Revenue	
	(Thousands omitted)		
1961 - Existing Bay Bridge	33,894	$10,526	(Exclusive of Bridge Railway)
Southern Crossing	2,792	941	
Total	36,686	$11,467	
1962 - Existing Bay Bridge	32,445	$10,012	(Exclusive of Bridge Railway)
Southern Crossing	6,410	2,130	
Total	38,855	$12,142	

Deleted from this report.
(Case II of December 1955 Report)

[illegible] - ESTIMATED TRAFFIC AND REVENUE - AT 35¢ BASE TOLL

[illegible] - 1963

Type of Vehicle (1)	EXISTING BAY BRIDGE Before Diversions (2)	Diversions to Southern Crossing (3)	Balance Remaining (4)	Average Toll (5)	Toll Revenue (6)	SAN MATEO-HAYWARD BRIDGE Before Diversions (7)	Diversions Equal Tolls (8)	Balance Remaining (9)	Average Toll (10)	Toll Revenue (11)	PROPOSED SOUTHERN CROSSING Vehicles (12)	Average Toll (13)	Toll Revenue (14)
						(Figures stated in thousands)							
1961 - JULY 1 TO DECEMBER 31 - TRANSBAY SECTION AND WEBSTER TUBE													
Passenger automobiles	14,449(A)	1,344	13,105	$.345	$ 4,5[illegible]	[illegible]	616	[illegible]	$.3[illegible]	$ [illegible]	[illegible]	$.[illegible]	[illegible]
Trucks	1,578	260	1,318	.934	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Buses	200	28	172	.849	146	[illegible]	[illegible]	[illegible]	.85	[illegible]	[illegible]	[illegible]	[illegible]
Subtotal	[illegible]	1,632	14,595		$ 5,898	2,[illegible]	[illegible]	1,34[illegible]		$ [illegible]	[illegible]		$[illegible]
Induced traffic (passenger cars and trucks)											[illegible]	[illegible]	[illegible]
Total	[illegible]	1,632	14,595		$ 5,898	2,0[illegible]3	71[illegible]	1,3[illegible]3		$ [illegible]	[illegible]		[illegible]
		(A) 90 per cent of passenger automobiles at 35¢ toll.											
1962 - JANUARY 1 TO JUNE 30 - TRANSBAY SECTION AND WEBSTER TUBE													
Passenger automobiles	14,774	1,374	13,400	$.345	$ 4,623	1,96[illegible]	[illegible]	[illegible]	$.3[illegible]	$ 444	[illegible]	$.[illegible]	[illegible]
Trucks	1,613	266	1,347	.934	1,255	214	9[illegible]	11[illegible]	.92	118	[illegible]	[illegible]	[illegible]
Buses	200	28	172	.849	146	2	0	2	.85	2	[illegible]	[illegible]	[illegible]
Subtotal	16,587	1,668	14,919		$ 6,0[illegible]	[illegible]	752	1,424		$ [illegible]54	2,[illegible]		[illegible]
Induced traffic (passenger cars and trucks)											150	[illegible]	[illegible]
Total - January 1 to June 30	16,587	1,668	14,919		$ 6,027	2,176	752	1,424		$ [illegible]54	2,[illegible]		[illegible]
1962 - JULY 1 TO DECEMBER 31 - ALL APPROACHES COMPLETED													
Passenger automobiles	14,774	2,438	12,336	$.345	$ 4,256	1,961	706	1,255	$.34	$ 427	3,144	$.[illegible]	$1,[illegible]
Trucks	1,613	274	1,339	.934	1,251	214	98	116	.92	107	372	.[illegible]	[illegible]
Buses	200	29	171	.849	145	2	0	2	.85	2	[illegible]9	.[illegible]	15
Subtotal	16,587	2,741	13,846		$ 5,652	2,177	804	1,373		$ 536	3,54[illegible]		$1,446
Induced traffic - 10 per cent of passenger automobiles and trucks on Southern Crossing											352	.430	[illegible]
Borderline passenger automobiles transferred to Southern Crossing (10 per cent of diversions from Bay Bridge)			-244	.345	-84						244	.345	84
Total - July 1 to December 31	16,587	2,741	13,602		$ 5,568	2,177	804	1,373		$ 536	4,141		$1,[illegible]
Total - January 1 to December 31, 1962	33,174	4,409	28,521		$11,595	4,353	1,556	2,797		$1,090	6,711		$2.799
1963 - ALL APPROACHES COMPLETED													
Passenger automobiles	30,212	4,985	25,227	$.345	$ 8,763	4,156	1,496	2,660	$.34	$ 904	6,481	$.345	$2,236
Trucks	3,299	561	2,738	.934	2,557	454	207	247	.92	227	768	.930	714
Buses	400	58	342	.849	290	3	0	3	.85	3	58	.531	31
Subtotal	33,911	5,604	28,307		$11,550	4,613	1,703	2,910		$1,134	7,307		$2,981
Induced traffic - 10 per cent of passenger automobiles and trucks on Southern Crossing											725	.430	[illegible]
Borderline passenger automobiles transferred to Southern Crossing (10 per cent of diversions from Bay Bridge)			-499	.345	-172						499	.345	172
Total	33,911	5,604	27,808		$11,378	4,613	1,703	2,910		$1,134	8,531		$3,465

SUMMARY - SOUTHERN CROSSING AND EXISTING BAY BRIDGE COMBINED

	Vehicles	Revenue	
	(Thousands Omitted)		
1961 - July 1-December 31			(Exclusive of Bridge Railway)
Existing Bay Bridge	14,595	$ 5,898	
Southern Crossing	2,492	1,084	
Total	17,087	$ 6,982	

	Vehicles	Revenue	
	(Thousands Omitted)		
1962 - Year			(Exclusive of Bridge Railway)
Existing Bay Bridge	28,521	$11,595	
Southern Crossing	6,711	2,799	
Total	35,232	$14,394	
1963 - Year			(Exclusive of Bridge Railway)
Existing Bay Bridge	27,808	$11,378	
Southern Crossing	8,531	3,465	
Total	36,339	$14,843	

POPULATION CHARACTERISTICS OF SAN FRANCISCO BAY AREA

Year	B Y C O U N T I E S																				State of California		
	San Francisco County			Alameda County			San Francisco and Alameda Counties			Contra Costa County			San Mateo County			Marin County			Total Five Bay Counties				
	Population	Increase	% Increase	Population	Increase	% Increase	Population	Increase	% Increase	Population	Increase	% Increase	Population	Increase	% Increase	Population	Increase	% Increase	Population	Increase	% Increase	Population	Increase	% Increase
1900	342,782			130,197			472,979			18,046			12,094			15,702			518,821			1,485,053		
1910	416,912	74,130	21.6	246,131	115,934	89.0	663,043	190,064	40.2	31,674	13,628	75.5	26,585	14,491	119.8	25,114	9,412	59.9	746,416	227,595	43.9	2,377,549	892,496	60.1
1920	506,676	89,764	21.5	344,177	98,046	39.8	850,853	187,810	28.3	53,889	22,215	70.1	36,781	10,196	38.4	27,342	2,228	8.9	968,865	222,449	29.8	3,426,861	1,049,312	44.1
1930	634,394	127,718	25.2	474,883	130,706	38.0	1,109,277	258,424	30.4	78,608	24,719	45.9	77,405	40,624	110.4	41,648	14,306	52.3	1,306,938	338,073	34.9	5,677,251	2,250,390	65.7
1940	634,536	142	0.02	513,011	38,128	8.0	1,147,547	38,270	3.4	100,450	21,842	27.8	111,782	34,377	44.4	52,907	11,259	27.0	1,412,686	105,748	8.1	6,907,387	1,230,136	21.7
1950	775,357	140,821	22.2	740,315	227,304	44.3	1,515,672	368,125	32.0	298,984	198,534	197.6	235,659	123,877	110.8	85,619	32,712	61.8	2,135,934	723,248	51.2	10,586,223	3,678,836	53.3
1954	785,900	10,543	1.4	838,900	98,585	13.3	1,624,800	109,128	7.2	335,200	36,216	12.1	321,900	86,241	36.6	100,700	15,081	17.6	2,382,600	246,666	11.5	12,595,000	2,008,777	19.0
1960	840,000	54,100	6.9	955,000	116,100	13.9	1,795,000	170,200	10.5	462,000	126,800	37.8	373,000	51,100	15.9	131,000	30,300	30.1	2,761,000	378,400	15.9	14,626,000	2,031,000	16.1
1970	840,000	-	-	1,125,000	170,000	17.8	1,965,000	170,000	9.5	585,000	123,000	26.6	480,000	107,000	28.7	170,000	39,000	29.8	3,200,000	439,000	15.9	18,068,000	3,442,000	23.5
1980	840,000	-	-	1,320,000	195,000	17.3	2,160,000	195,000	9.9	752,000	167,000	28.5	550,000	70,000	14.6	215,000	45,000	26.5	3,677,000	477,000	14.9	20,395,000	2,327,000	12.9
1990	850,000	10,000	1.2	1,510,000	190,000	14.4	2,360,000	200,000	9.3	925,000	173,000	23.0	620,000	70,000	12.7	260,000	45,000	20.9	4,165,000	488,000	13.3	21,006,000	611,000	3.0

Notes: Populations from 1880-1950 taken from Bureau of Census, Department of Commerce.
Census figures include persons on ships and other transients. Estimated figures do not include those transients.

Year	B Y C I T I E S																	
	San Francisco			Oakland			Berkeley (1)			Alameda			Richmond (2)			South San Francisco		
	Population	Increase	% Increase	Population	Increase	% Increase	Population	Increase	% Increase	Population	Increase	% Increase	Population	Increase	% Increase	Population	Increase	% Increase
1900	342,782			66,960			13,214			16,464								
1910	416,912	74,130	21.6	150,174	83,214	124.3	40,434	27,220	206.0	23,383	6,919	42.0	6,802					
1920	506,676	89,764	21.5	216,261	66,087	44.0	56,036	15,602	38.6	28,806	5,423	23.2	16,843	10,041	147.6			
1930	634,394	127,718	25.2	284,063	67,802	31.4	82,109	26,073	46.5	35,033	6,227	21.6	20,093	3,250	19.3			
1940	634,536	142	0.2	302,163	18,100	6.4	85,547	3,438	4.2	36,256	1,223	3.5	23,642	3,549	17.7	6,629		
1950	775,357	140,821	22.2	384,375	82,212	27.2	113,805	28,258	33.0	64,430	28,174	77.7	99,545	75,903	321.1	19,351	12,722	191.9
1954	785,900(5)	10,543	1.4	400,000(5)	15,625	4.1	118,350(5)	4,545	4.0	71,000(5)	6,570	10.2	101,000(5)	1,455	1.5	29,500(5)	10,149	52.5
Year	Piedmont (3)			Albany (4)			Emeryville			El Cerrito			San Mateo			Total Bay Cities		
	Population	Increase	% Increase	Population	Increase	% Increase	Population	Increase	% Increase	Population	Increase	% Increase	Population	Increase	% Increase	Population	Increase	% Increase
1900							1,016						1,832			442,268		
1910	1,719			808			2,613	1,597	157.2				4,384	2,552	139.3	647,229	204,961	46.3
1920	4,282	2,563	149.1	2,462	1,654	204.7	2,390	-223	-8.5	1,505			5,979	1,595	36.4	841,240	194,011	30.0
1930	9,333	5,051	118.0	8,569	6,107	248.1	2,336	-54	-2.3	3,870	2,365	157.1	13,444	7,465	124.9	1,093,244	252,004	30.0
1940	9,866	533	5.7	11,493	2,924	34.1	2,521	185	7.9	6,137	2,267	58.6	19,403	5,959	44.3	1,138,193	44,949	4.1
1950	10,132	266	2.7	17,590	6,097	53.0	2,889	368	14.6	18,011	11,874	193.5	41,782	22,379	115.3	1,547,267	409,074	35.9
1954	11,050(5)	918	9.1	18,100(5)	510	2.4	2,800(5)	-89	-3.1	22,500(5)	4,489	24.9	53,900(5)	12,118	29.0	1,614,100	66,733	4.3

Notes: Populations from 1900-1950 taken from Bureau of Census, Department of Commerce.
(1) Parts of Oakland annexed 1906 and 1908.
(2) Incorporated 1908.
(3) Incorporated 1907. That part of Piedmont City in Brooklyn Township annexed to Oakland Township and part of Oakland Township annexed to Berkeley City since 1920.
(4) Incorporated 1908.
(5) Estimates by California State Department of Finance.

BUSINESS STATISTICS

BAY AREA

Year	Index of Industrial Production - U.S. (1)		Index of Business Activity San Francisco (2)		Index of Department Store Sales San Francisco-Oakland Metropolitan District (3)		Electric Power Sales San Francisco and East Bay Divisions (4)		Manufacturing Production Workers San Francisco-Oakland Metropolitan Area (5)	
	(1947-49=100)	Per Cent Increase	(1947-49=100)	Per Cent Increase	(1947-49=100)	Per Cent Increase	Kwh (000,000 Omitted)	Per Cent Increase	Number (000 omitted)	Per Cent Increase
1940	67		47.7		38		1,910		84.0	
1941	87	29.9	54.5	14.3	42	10.5	2,122	11.1	112.1	33.5
1942	106	21.8	63.0	15.6	53	26.2	2,519	18.7	197.1	75.8
1943	127	19.8	77.2	22.5	62	17.0	3,122	23.9	279.7	41.9
1944	125	1.6*	84.0	8.8	70	12.9	3,510	12.4	257.7	7.9*
1945	107	14.4*	89.7	6.8	78	11.4	3,402	3.1*	179.2	30.5*
1946	90	15.9*	93.0	3.7	93	19.2	3,083	9.4*	120.1	33.0*
1947	100	11.1	98.0	5.4	97	4.3	3,233	4.9	131.2	9.2
1948	104	4.0	101.3	3.4	102	5.2	3,264	1.0	124.9	4.8*
1949	97	6.7*	100.6	0.7*	100	2.0*	3,472	6.4	116.3	6.9*
1950	112	15.5	108.4	7.8	107	7.0	3,764	8.4	122.6	5.4
1951	120	7.1	121.6	12.2	113	5.6	4,264	13.3	135.1	10.2
1952	124	3.3	125.9	3.5	116	2.7	4,511	5.8	135.2	0.1
1953	134	8.1	127.8	1.5	117	0.9	4,795	6.3	140.1	3.6
1954	125	6.7*	128.5	0.5	119	1.7	4,964	3.5	132.3	5.6*
1955	139	11.2	139.3	8.4	123	3.4	5,411	9.0	133.0	0.5

Notes:
* Decrease

(1) Survey of Current Business - Department of Commerce.
(2) San Francisco Chamber of Commerce.
(3) San Francisco Federal Reserve Bank.
(4) Pacific Gas and Electric Co.
(5) California State Department of Industrial Relations.

FACTORS USED IN PROJECTING FUTURE TRAFFIC

Year	San Francisco and Alameda Counties				Five Bay Counties				State of California						Simple Average Columns 5 and 9
	Population	% Increase	Motor Vehicle Registration	% Increase	Population	% Increase	Motor Vehicle Registration	% Increase	Population	% Increase	Motor Vehicle Registration	% Increase	Gasoline Consumption (Billion Gallons) (2)	% Increase	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
1925	980,045		220,451		1,137,881		260,057		4,552,056		1,475,852		.636		
1926	1,005,891	2.64	247,732	12.37	1,171,691	2.97	293,970	13.04	4,777,095	4.94	1,640,294	11.14	.750	17.92	12.71
1927	1,031,737	2.57	261,836	5.69	1,205,501	2.88	311,533	5.97	5,002,134	4.71	1,736,765	5.88	.845	12.67	5.83
1928	1,057,583	2.51	277,614	6.03	1,239,312	2.80	330,828	6.19	5,227,173	4.50	1,846,412	6.31	.843	-.24	6.11
1929	1,083,429	2.44	298,717	7.60	1,273,123	2.73	358,536	8.37	5,452,212	4.31	2,026,868	9.77	1.038	23.13	7.99
1930	1,109,277*	2.38	306,194	2.50	1,306,938*	2.65	369,892	3.17	5,677,251*	4.13	2,099,293	3.57	1.129	8.77	2.84
1931	1,113,000	0.34	306,679	0.16	1,317,500	0.81	372,673	0.75	5,800,300	2.16	2,107,275	0.38	1.288	14.08	0.46
1932	1,117,000	0.36	297,960	-2.84	1,328,100	0.80	364,217	-2.27	5,923,300	2.12	2,041,824	-3.11	1.240	-3.73	-2.56
1933	1,121,000	0.36	292,916	-1.69	1,338,700	0.80	360,997	-0.88	6,046,300	2.08	2,036,918	-0.24	1.184	-4.52	-1.29
1934	1,125,000	0.36	295,289	0.81	1,349,200	0.78	365,908	1.36	6,169,300	2.04	2,080,884	2.16	1.219	2.96	1.09
1935	1,129,000	0.36	316,185	7.08	1,359,800	0.79	392,566	7.29	6,292,300	2.00	2,254,828	8.36	1.220	.08	7.18
1936	1,132,000	0.27	344,346	8.91	1,370,400	0.78	427,155	8.81	6,415,300	1.96	2,448,925	8.61	1.412	15.74	8.86
1937	1,136,000	0.35	366,185	6.34	1,381,000	0.77	455,601	6.66	6,538,300	1.92	2,627,640	7.30	1.473	4.32	6.50
1938	1,140,000	0.35	367,710	0.42	1,391,500	0.76	459,866	0.94	6,661,400	1.88	2,663,733	1.37	1.571	6.65	.68
1939	1,147,000	0.61	379,624	3.24	1,402,100	0.76	478,111	3.97	6,784,400	1.84	2,773,698	4.13	1.572	.06	3.61
1940	1,147,547*	0.05	401,420	5.74	1,412,686*	0.76	509,237	6.51	6,907,387*	1.81	2,955,952	6.57	1.687	7.32	6.12
1941	1,215,000	5.88	423,379	5.47	1,519,400	7.55	542,708	6.57	7,262,000	5.14	3,163,394	7.02	1.788	5.99	6.02
1942	1,282,000	5.51	404,672	-4.42	1,626,100	7.02	527,388	-2.82	7,635,000	5.14	3,042,152	-3.83	1.915(1)	7.10	-3.62
1943	1,350,000	5.30	401,266	-0.84	1,732,800	6.56	540,490	2.48	8,027,000	5.14	2,944,572	-3.21	1.514(1)	-20.94	.82
1944	1,417,000	4.96	393,583	-1.91	1,839,500	6.15	540,396	-0.02	8,440,000	5.14	2,993,224	1.65	1.415(1)	-6.54	-.97
1945	1,483,600	4.70	402,850	2.35	1,946,200	5.80	555,614	2.63	8,874,000	5.14	3,118,840	4.20	1.465(1)	3.53	2.49
1946	1,497,600	0.94	427,536	6.13	1,997,600	2.64	583,604	5.23	9,330,000	5.14	3,442,051	10.36	1.973	34.68	5.68
1947	1,511,500*	0.93	511,600	19.66	2,048,900*	2.57	648,340	11.09	9,812,000*	5.17	3,879,531	12.71	2.445	23.92	10.70
1948	1,513,000	0.10	508,139	-0.68	2,077,000	1.35	704,851	8.72	10,057,000	2.50	4,175,867	7.64	2.596	6.18	4.02
1949	1,514,500	0.10	542,390	6.74	2,105,000	1.35	766,696	8.77	10,308,000	2.50	4,514,241	8.10	2.761	6.36	7.75
1950	1,515,672*	0.08	588,266	8.45	2,135,934*	1.47	845,901	10.33	10,586,223*	2.70	5,043,368	11.72	2.961	7.24	9.39
1951	1,541,438	1.70	616,956	4.87	2,195,740	2.80	900,519	6.46	11,052,000	4.40	5,367,514	6.43	3.306	11.65•	5.67
1952	1,567,642	1.70	619,084	0.34	2,257,221	2.80	921,623	2.34	11,538,000	4.40	5,617,007	4.65	3.450	4.36	1.34
1953	1,594,292	1.70	646,568	4.43	2,320,454	2.80	972,436	5.51	12,045,000	4.39	5,996,256	6.75	3.662	6.14	4.97
1954	1,621,000	1.68	652,303	0.88	2,382,600	2.68	992,412	2.05	12,595,000(3)	4.57	6,119,264	2.05	3.701	1.06	1.47
1955	1,649,000	1.73	689,902	5.76	2,442,000	2.49	1,066,805	7.50	13,035,000	3.49	6,649,765	8.67	4.274Est.	15.48	6.63
1956	1,677,000	1.70	701,600	1.70	2,503,000	2.50	1,094,000	2.51	13,334,000	2.29	6,803,000	2.30	4.373	2.32	2.11
1957	1,706,000	1.73	713,700	1.73	2,566,000	2.52	1,121,000	2.49	13,641,000	2.30	6,959,000	2.30	4.473	2.29	2.11
1958	1,735,000	1.70	725,800	1.70	2,630,000	2.49	1,149,000	2.53	13,955,000	2.30	7,474,000	7.40	4.804	7.40	2.11
1959	1,764,000	1.67	737,300	1.58	2,696,000	2.51	1,177,000	2.46	14,275,000	2.29	7,647,000	2.31	4.915	2.31	2.02
1960	1,795,000	1.76	750,300	1.76	2,761,000	2.41	1,205,000	2.40	14,626,000	2.46	7,834,000	2.45	5.036	2.46	2.08
1970	1,965,000	9.47	873,800	16.46	3,200,000	15.90	1,458,000	20.96	18,068,000	23.53	10,187,000	30.03	6.548	30.02	18.71
1980	2,160,000	9.92	1,026,000	17.44	3,677,000	14.91	1,771,000	21.50	20,394,000	12.87	11,499,000	12.88	7.392	12.89	19.47
1990	2,360,000	9.26	1,233,000	20.16	4,165,000	13.27	2,188,000	23.56	21,426,000	5.06	12,748,000	10.86	8.194	10.85	21.86

U. S. Bureau of Census

(1) Gasoline rationing in effect as follows: 4 Gallons per month - December 2, 1942 2 Gallons per month - March 22, 1944
3 Gallons per month - October 12, 1943 End of rationing - August 15, 1945

(2) Year ending June 30
(3) State Department of Finance

SAN FRANCISCO-OAKLAND BAY BRIDGE

Projection of Traffic and Revenue - 1955-1961

Year	Revenue Vehicles (000)	Average Toll (¢)	Revenue (000 $)	Bridge Railway (000 $)	Total (000 $)	Revenue Vehicles Annual Per Cent Increase
1955	31,242	.313	9,770	103	9,873	
1956	31,945	.313	9,999	101	10,100	2.25
1957(1)	32,660	.313	10,223	100	10,323	2.25
1958	33,386	.313	10,450	100	10,550	2.25
1959	34,128	.313	10,682	100	10,782	2.25
1960	34,887	.313	10,920	100	11,020	2.25
1961(2)	35,663	.313	11,163	100	11,263	2.25

(1) Buses not expanded over 400,000.

(2) Estimated as if Southern Crossing not in existence.

SAN FRANCISCO-OAKLAND BAY BRIDGE

PROJECTION OF EARNINGS - 1955-1961, INCLUSIVE

25¢ BASE TOLL

Year	Revenue from Tolls	Nonoperating Income		Total Revenues	Maintenance and Operations	Insurance and Fiduciary(C)	Total Expenses	Net Earnings
		Interest on Funds Invested	Income from Concessions and Rents					
	(Figures stated in thousands)							
1955	$ 9,873	$544(A)	$173	$10,590	$1,751	$151	$1,902	$ 8,688
1956	10,100	338(B)	170	10,608	1,901	154	2,055	8,553
1957	10,323	338	170	10,831	1,949	204	2,153	8,678
1958	10,550	338	170	11,058	1,998	204	2,202	8,856
1959	10,782	338	170	11,290	2,048	204	2,252	9,038
1960	11,020	338	170	11,528	2,099	204	2,303	9,225
1961 (1st 6 mos.)	5,632	169	85	5,886	1,076	102	1,178	4,708
Net Earnings January 1, 1957 to June 30, 1961								$40,505

(A) Interest at 2-1/4 per cent on reserve of $25,000,000 to December 1, and $15,000,000 thereafter.

(B) Interest at 2-1/4 per cent on reserve of $15,000,000.

(C) $50,000 fiduciary costs from 1957 on.

SOUTHERN CROSSING AND EXISTING BAY BRIDGE

CASE I - PROJECTION OF TRAFFIC AND REVENUE - 1961-1997

25¢ BASE TOLL

CONSTRUCTION AS DEFINED ON FIGURE IX - 1

Year	Existing Bay Bridge						Southern Crossing				Total Revenues	Operating and Maintenance Expense	Insurance and Fiduciary	Net from Operations	Concessions and Rents	Net Revenue
	Vehicles	Per Cent Annual Increase	Average Toll	Revenue from Vehicles	Bridge Railway Revenue(E)	Total Revenue	Vehicles	Per Cent Annual Increase	Average Toll	Revenue						
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
	(Figures Stated in Thousands)															
1961 (A)	33,894		$.309	$10,526	$100	$10,626	2,792		$.337	$ 941	$11,567	$ 2,574	$130(B)	$ 8,863	$180	$ 9,043
1962	32,445	2.25	.309	10,012	100	10,112	6,410	6.0	.332	2,130	12,242	3,111	400	8,731	180	8,911
1963	33,175	2.25	.309	10,251	100	10,351	6,795	6.0	.332	2,256	12,607	3,191	400	9,016	180	9,196
1964	33,921	2.25	.309	10,482	100	10,582	7,203	6.0	.332	2,391	12,973	3,273	400	9,300	180	9,480
1965	34,684	2.25	.309	10,717	100	10,817	7,635	6.0	.332	2,535	13,352	3,355	400	9,597	180	9,777
1966	35,464	2.25	.309	10,958	100	11,058	8,017	5.0	.332	2,662	13,720	3,471	400	9,849	180	10,029
1967	36,262	2.25	.309	11,205	100	11,305	8,418	5.0	.332	2,795	14,100	3,637	400	10,063	180	10,243
1968(C)	37,078	2.25	.309	11,457	100	11,557	8,839	5.0	.332	2,935	14,492	3,754	400	10,338	180	10,518
1969	37,912	2.25	.309	11,715	100	11,815	9,281	5.0	.332	3,081	14,896	3,870	400	10,626	180	10,806
1970	38,765	2.25	.309	11,978	100	12,078	9,745	5.0	.332	3,235	15,313	3,987	400	10,926	180	11,106
1971	39,637	2.25	.309	12,248	100	12,348	10,135	4.0	.332	3,365	15,713	4,103	400	11,210	180	11,390
1972	40,529	2.25	.309	12,523	100	12,623	10,540	4.0	.332	3,499	16,122	4,220	400	11,502	180	11,682
1973	41,441	2.25	.309	12,805	100	12,905	10,962	4.0	.332	3,639	16,544	4,336	400	11,808	180	11,988
1974	42,373	2.25	.309	13,093	100	13,193	11,400	4.0	.332	3,785	16,978	4,486	400	12,092	180	12,272
1975	43,326	2.25	.309	13,388	100	13,488	11,856	4.0	.332	3,936	17,424	4,690	400	12,334	180	12,514
1976	44,193	2.00	.309	13,656	100	13,756	12,271	3.5	.332	4,074	17,830	4,841	400	12,589	180	12,769
1977	45,077	2.00	.309	13,929	100	14,029	12,700	3.5	.332	4,216	18,245	4,991	400	12,854	180	13,034
1978	45,979	2.00	.309	14,208	100	14,308	13,145	3.5	.332	4,364	18,672	5,137	400	13,135	180	13,315
1979	46,899	2.00	.309	14,492	100	14,592	13,605	3.5	.332	4,517	19,109	5,277	400	13,432	180	13,612
1980	47,837	2.00	.309	14,782	100	14,882	14,081	3.5	.332	4,675	19,557	5,420	400	13,737	180	13,917
1981	48,674	1.75	.309	15,040	100	15,140	14,503	3.0	.332	4,815	19,955	5,563	400	13,992	180	14,172
1982	49,526	1.75	.309	15,304	100	15,404	14,938	3.0	.332	4,959	20,363	5,706	400	14,257	180	14,437
1983	50,392	1.75	.309	15,571	100	15,671	15,386	3.0	.332	5,108	20,779	5,849	400	14,530	180	14,710
1984	51,274	1.75	.309	15,844	100	15,944	15,848	3.0	.332	5,262	21,206	5,992	400	14,814	180	14,994
1985	52,171	1.75	.309	16,121	100	16,221	16,323	3.0	.332	5,419	21,640	6,238	400	15,002	180	15,182
1986	53,084	1.75	.309	16,403	100	16,503	16,813	3.0	.332	5,582	22,085	6,381	400	15,304	180	15,484
1987(D)	54,013	1.75	.309	16,690	100	16,790	15,987	3.0	.332	5,308	22,098	6,526	400	15,172	180	15,352
1988	54,013	-	.309	16,690	100	16,790	15,987	-	.332	5,308	22,098	6,652	400	15,046	180	15,226
1989	54,013	-	.309	16,690	100	16,790	15,987	-	.332	5,308	22,098	6,781	400	14,917	180	15,097
1990	54,013	-	.309	16,690	100	16,790	15,987	-	.332	5,308	22,098	6,912	400	14,786	180	14,966
1991	54,013	-	.309	16,690	100	16,790	15,987	-	.332	5,308	22,098	7,045	400	14,653	180	14,833
1992	54,013	-	.309	16,690	100	16,790	15,987	-	.332	5,308	22,098	7,181	400	14,517	180	14,697
1993	54,013	-	.309	16,690	100	16,790	15,987	-	.332	5,308	22,098	7,320	400	14,378	180	14,558
1994	54,013	-	.309	16,690	100	16,790	15,987	-	.332	5,308	22,098	7,461	400	14,237	180	14,417
1995	54,013	-	.309	16,690	100	16,790	15,987	-	.332	5,308	22,098	7,605	400	14,093	180	14,273
1996	54,013	-	.309	16,690	100	16,790	15,987	-	.332	5,308	22,098	7,752	400	13,946	180	14,126
1997	54,013	-	.309	16,690	100	16,790	15,987	-	.332	5,308	22,098	7,902	400	13,796	180	13,976

(A) Assumed that by July 1, 1961 the Southern Crossing will be open between Army and 3rd Streets and Bay Farm Island, and that the Webster Street tube will be completed.

(B) Part of insurance paid from construction funds in 1961.

(C) By the end of 1968 the capacity of the Bay Bridge will be reached, and vehicles over an annual rate of 37,000,000 will be obliged to use the Southern Crossing. For convenience, the projections are carried out as shown, subject to the above condition.

(D) By the end of 1987 the capacities of both crossings will be reached, assuming no change in the layout of Bay Bridge.

(E) The future revenues from the Bridge Railway are not predictable. Any transfer of passengers from Railway to automobile will tend to increase the over-all revenue of the Bridge.

Table VIII - 13

Deleted from this report.
(Case II of December 1955 Report)

SOUTHERN CROSSING AND EXISTING BAY BRIDGE

CASE III - PROJECTION OF TRAFFIC AND REVENUE - 1961-1997

35¢ BASE TOLL

CONSTRUCTION AS DEFINED IN FIGURE IX - 3

Year	Existing Bay Bridge						Southern Crossing				Total Revenues	Operating and Maintenance Expense	Insurance and Fiduciary	Net from Operations	Con-cessions and Rents	Net Revenue
	Vehicles	Per Cent Annual Increase	Average Toll	Revenue from Vehicles	Bridge Railway Revenue(F)	Total Revenue	Vehicles	Per Cent Annual Increase	Average Toll	Revenue						
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
	(Figures Stated in Thousands)															
1961 - 6 mos. (A)	14,595			$ 5,898	$ 50	$ 5,948	2,492			$ 1,084	$ 7,032	$1,498	$130(C)	$ 5,404	$ 90	$ 5,494
1961 - year	30,822			12,527	100	12,627	2,492			1,084	13,711	2,574	130	11,007	180	11,187
1962 (B)	28,521			11,595	100	11,695	6,711			2,799	14,494	3,111	292(C)	11,091	180	11,271
1963	27,808	2.25	$.408	11,378	100	11,478	8,531	6.0	$.406	3,465	14,943	3,191	415	11,337	180	11,517
1964	28,434	2.25	.408	11,601	100	11,701	9,045	6.0	.406	3,671	15,372	3,273	415	11,684	180	11,864
1965	29,074	2.25	.408	11,862	100	11,962	9,586	6.0	.406	3,892	15,854	3,355	415	12,084	180	12,264
1966	29,728	2.25	.408	12,129	100	12,229	10,065	5.0	.406	4,086	16,315	3,471	415	12,429	180	12,609
1967	30,397	2.25	.408	12,402	100	12,502	10,568	5.0	.406	4,291	16,793	3,637	415	12,741	180	12,921
1968	31,081	2.25	.408	12,681	100	12,781	11,096	5.0	.406	4,505	17,286	3,754	415	13,117	180	13,297
1969	31,780	2.25	.408	12,966	100	13,066	11,651	5.0	.406	4,730	17,796	3,870	415	13,511	180	13,691
1970	32,495	2.25	.408	13,258	100	13,358	12,234	5.0	.406	4,967	18,325	3,987	415	13,923	180	14,103
1971	33,226	2.25	.408	13,556	100	13,656	12,723	4.0	.406	5,166	18,822	4,103	415	14,304	180	14,484
1972	33,974	2.25	.408	13,861	100	13,961	13,232	4.0	.406	5,372	19,333	4,220	415	14,698	180	14,878
1973	34,738	2.25	.408	14,173	100	14,273	13,761	4.0	.406	5,587	19,860	4,336	415	15,109	180	15,289
1974	35,520	2.25	.408	14,492	100	14,592	14,311	4.0	.406	5,810	20,402	4,486	415	15,501	180	15,681
1975	36,319	2.25	.408	14,818	100	14,918	14,883	4.0	.406	6,042	20,960	4,690	415	15,855	180	16,035
1976(D)	37,045	2.00	.408	15,114	100	15,214	15,478	4.0	.406	6,284	21,498	4,841	415	16,242	180	16,422
1977	37,786	2.00	.408	15,417	100	15,517	16,097	4.0	.406	6,535	22,052	4,991	415	16,646	180	16,826
1978	38,542	2.00	.408	15,725	100	15,825	16,741	4.0	.406	6,797	22,622	5,137	415	17,070	180	17,250
1979	39,313	2.00	.408	16,040	100	16,140	17,411	4.0	.406	7,069	23,209	5,277	415	17,517	180	17,697
1980	40,099	2.00	.408	16,360	100	16,460	18,107	4.0	.406	7,351	23,811	5,420	415	17,976	180	18,156
1981	40,801	1.75	.408	16,647	100	16,747	18,831	4.0	.406	7,645	24,392	5,563	415	18,414	180	18,594
1982	41,515	1.75	.408	16,938	100	17,038	19,584	4.0	.406	7,951	24,989	5,706	415	18,868	180	19,048
1983	42,242	1.75	.408	17,235	100	17,335	20,367	4.0	.406	8,269	25,604	5,849	415	19,340	180	19,520
1984	42,981	1.75	.408	17,536	100	17,636	21,182	4.0	.406	8,600	26,236	5,992	415	19,829	180	20,009
1985	43,733	1.75	.408	17,843	100	17,943	22,029	4.0	.406	8,944	26,887	6,238	415	20,234	180	20,414
1986	44,498	1.75	.408	18,155	100	18,255	22,910	4.0	.406	9,301	27,556	6,381	415	20,760	180	20,940
1987	45,277	1.75	.408	18,473	100	18,573	23,826	4.0	.406	9,673	28,246	6,526	415	21,305	180	21,485
1988(E)	46,069	1.75	.408	18,796	100	18,896	24,779	4.0	.406	10,060	28,956	6,652	415	21,889	180	22,069
1989	46,069	-	.408	18,796	100	18,896	24,779	-	.406	10,060	28,956	6,781	415	21,760	180	21,940
1990	46,069	-	.408	18,796	100	18,896	24,779	-	.406	10,060	28,956	6,912	415	21,629	180	21,809
1991	46,069	-	.408	18,796	100	18,896	24,779	-	.406	10,060	28,956	7,045	415	21,496	180	21,676
1992	46,069	-	.408	18,796	100	18,896	24,779	-	.406	10,060	28,956	7,181	415	21,360	180	21,540
1993	46,069	-	.408	18,796	100	18,896	24,779	-	.406	10,060	28,956	7,320	415	21,221	180	21,401
1994	46,069	-	.408	18,796	100	18,896	24,779	-	.406	10,060	28,956	7,461	415	21,080	180	21,260
1995	46,069	-	.408	18,796	100	18,896	24,779	-	.406	10,060	28,956	7,605	415	20,936	180	21,116
1996	46,069	-	.408	18,796	100	18,896	24,779	-	.406	10,060	28,956	7,752	415	20,789	180	20,969
1997	46,069	-	.408	18,796	100	18,896	24,779	-	.406	10,060	28,956	7,902	415	20,639	180	20,819

(A) Assumed that by July 1961 the Southern Crossing will be open between Army and 3rd Streets and Bay Farm Island, and that the Webster Street tube will be completed.

(B) Assumed that by July 1962 all approaches will be completed.

(C) Part of insurance paid from construction funds in 1961 and 1962.

(D) By the end of 1976 the capacity of the Bay Bridge in its present form will be reached and vehicles over an annual rate of 37,000,000 will be obliged to use the Southern Crossing. For convenience, the projections are carried out as shown, subject to the above condition.

(E) By the end of 1988 the capacities of both crossings will be reached, assuming no change in layout of Bay Bridge.

(F) The future revenues from the Bridge Railway are not predictable. Any transfer of passengers from railway to automobile will tend to increase the over-all revenues of the Bridge.

TABLE VIII-15

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(Case II of December 1955 Report)

TABLE VIII-17

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EMBARCADERO APPROACH TO SOUTHERN CROSSING

ESTIMATED SOUTHBOUND AFTERNOON PEAK-HOUR TRAFFIC

	No.of Lanes South-bound	1963						1975					
		On and Off Traffic			Total on Approach			On and Off Traffic			Total on Approach		
		To Southern Crossing	Other Traffic	Total Traffic	To Southern Crossing	Other Traffic	Total Traffic	To Southern Crossing	Other Traffic	Total Traffic	To Southern Crossing	Other Traffic	Total Traffic
From Embarcadero Freeway		142	448	590				276	569	845			
	3				142	448	590				276	569	845
From Spear Street Ramp		233	1,563	1,796				455	1,983	2,438			
	3				375	2,011	2,386				731	2,552	3,283
From 4th Street Ramp		112	1,250	1,362				218	1,586	1,804			
	3				487	3,261	3,748				949	4,138	5,087
To 16th Street Ramp		-	712	712				-	904	904			
	3				487	2,549	3,036				949	3,234	4,183
From Mariposa Street Ramp		23	374	397				44	476	520			
	3				510	2,923	3,433				993	3,710	4,703
To Southern Freeway		-	2,924	2,924				-	3,710	3,710			
	3				510	-	510				993	-	993
From 23rd Street Ramp		68	-	68				132	-	132			
	3				578	-	578				1,125	-	1,125
From Southern Freeway		457	-	457				891	-	891			
	3				1,035	-	1,035				2,016	-	2,016
From Army Street Ramp		266	-	266				519	-	519			
							1,301						
Net to Southern Crossing					1,301	-	1,301				2,535	-	2,535

SAN FRANCISCO-OAKLAND BAY BRIDGE AND SOUTHERN CROSSING

TRANSBAY VEHICULAR TRAFFIC AND REVENUE 1955 AND FIRST FULL YEAR OF OPERATION OF SOUTHERN CROSSING

CASE I - 1962, CASE III - 1963

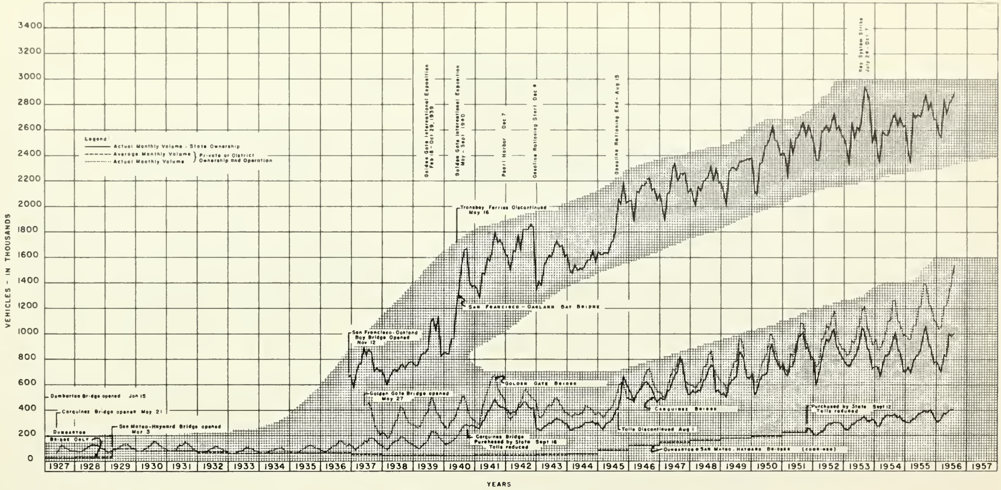
Type of Vehicular Traffic	SAN FRANCISCO-OAKLAND BAY BRIDGE						SAN MATEO-HAYWARD BRIDGE			SOUTHERN CROSSING						COMBINED - SAN FRANCISCO-OAKLAND BAY BRIDGE AND SOUTHERN CROSSING				
	Before Diversion	Diversion to Southern Crossing		Remaining After Diversion			Before Diversion	Diversion to Southern Crossing		Diversions From SF-OBB	Diversions From SM-HB	Induced Traffic	Total Traffic			San Francisco-Oakland Bay Bridge		Southern Crossing		Total
	1,000 Vehicles	Per Cent	1,000 Vehicles	1,000 Vehicles	Average Toll	Revenue $1,000	1,000 Vehicles	Per Cent	1,000 Vehicles	1,000 Vehicles	1,000 Vehicles	1,000 Vehicles	1,000 Vehicles	Average Toll	Revenue $1,000	1,000 Vehicles	% of Total	1,000 Vehicles	% of Total	1,000 Vehicles
CASE I - 25-CENT AUTO TOLL																				
1955																				
Passenger autos	28,095	7.7	2,163	25,932	$.245	$6,353	2,607	42.2	1,100	2,163	1,100		3,263	$.245	$799	25,932	88.8	3,263	11.2	29,195
Trucks	2,761	13.7	378	2,383	.934	2,226	285	45.3	129	378	129		507	.925	469	2,383	82.5	507	17.5	2,890
Buses	386	14.5	56	330	.849	280	3	0.0	0	56	0		56	.531	30	330	85.5	56	14.5	386
Induced traffic																				
Total	31,242	8.3	2,597	28,645	.309	$ 8859	2,895	42.5	1,229	2597	1,229		3,826	.339	$1,298	28,645	88.2	3826	11.8	30,471
1962																				
Passenger autos	32,830	9.5	3,123	29,707	$.245	$ 7,278	3,921	42.2	1,655	3,123	1,655		4,778	$.245	$1,171	29,407(B)	86.0	4,778	14.0	34,185
Trucks	3,226	16.5	532	2,694	.934	2,516	428	45.3	194	532	194		726	.925	672	2,694	78.8	726	21.2	3,420
Buses	400	14.0	56	344	.849	292	3	0.0	0	56	0		56	.531	30	344	86.0	56	14.0	400
Induced traffic				-300(A)	.245	-74				300		550	850	.302	257			850	100.0	850
Total	36,456	10.2	3,711	32,445	.309	$10,012	4,352	42.5	1,849	4,011	1,849	550	6,410	.332	$2,130	32,445	83.5	6,410	16.5	38,855
CASE III - 35-CENT AUTO TOLL																				
1955																				
Passenger autos	25,285	7.7	1,947	23,338	$.345	$ 8,052	2,607	33.4	871	1,947	871		2,818	$.345	$ 972	23,338	89.2	2,818	10.8	26,156
Trucks	2,761	13.7	378	2,383	.934	2,226	285	45.3	129	378	129		507	.930	472	2,383	82.5	507	17.5	2,890
Buses	386	14.5	56	330	.849	280	3	0.0	0	56	0		56	.531	30	330	85.5	56	14.5	386
Induced traffic																				
Total	28,432	8.4	2,381	26,051	.405	$10,558	2,895	34.5	1,000	2,381	1,000		3,381	.430	$1,474	26,051	88.5	3,381	11.5	29,432
1963																				
Passenger autos	30,212	16.5	4,985	25,227	$.345	$ 8,703	4,156	36.0	1,496	4,985	1,496		6,481	$.345	$2,236	24,728(B)	79.3	6,481	20.7	31,209
Trucks	3,299	17.0	561	2,738	.934	2,557	454	45.7	207	561	207		768	.930	714	2,738	78.1	768	21.9	3,506
Buses	400	14.5	58	342	.849	290	3	0.0	0	58	0		58	.531	31	342	85.5	58	14.5	400
Induced traffic				-499(A)	.345	-172				499(A)		725	1,224	.395	484			1,224	100.0	1,224
Total	33,911	16.5	5,604	27,808	.409	$11,378	4,613	36.9	1,703	6,103	1,703	725	8,531	.406	$3,465	27,808	76.5	8,531	23.5	36,339

(A) Borderline passenger automobiles transferred to Southern Crossing.
(B) Including deduction of borderline automobiles.

DISTRIBUTION OF VEHICULAR TRAFFIC BETWEEN SAN FRANCISCO-OAKLAND BAY BRIDGE AND SOUTHERN CROSSING

Year	CASE I - 25-CENT TOLL					CASE III - 35-CENT TOLL				
	SAN FRANCISCO-OAKLAND BAY BRIDGE		SOUTHERN CROSSING		Total 1,000 Vehicles	SAN FRANCISCO-OAKLAND BAY BRIDGE		SOUTHERN CROSSING		Total 1,000 Vehicles
	1,000 Vehicles	% of Total	1,000 Vehicles	% of Total		1,000 Vehicles	% of Total	1,000 Vehicles	% of Total	
1961	33,894	92.4	2,792	7.6	36,686	28,828	92.0	2,492	8.0	31,320
1962	32,445	83.5	6,410	16.5	38,855	28,521	81.0	6,711	19.0	35,232
1963	33,175	83.0	6,795	17.0	39,970	27,808	76.5	8,531	23.5	36,339
1964	33,921	82.5	7,203	17.5	41,124	28,434	75.9	9,343	24.1	37,777
1965	34,684	82.0	7,635	18.0	42,319	29,074	74.7	9,856	25.3	38,930
1966	35,464	81.6	8,017	18.4	43,481	29,728	74.7	10,065	25.3	39,793
1967	36,262	81.2	8,418	18.8	44,680	30,397	74.2	10,568	25.8	40,965
1968	37,000	80.6	8,917	19.4	45,917	31,081	73.7	11,096	26.3	42,177
1969	37,000	78.4	10,193	21.6	47,193	31,780	73.2	11,651	26.8	43,431
1970	37,000	76.3	11,510	23.7	48,510	32,495	72.6	12,234	27.4	44,729
1971	37,000	74.3	12,772	25.7	49,772	33,226	72.3	12,723	27.7	45,949
1972	37,000	72.5	14,069	27.5	51,069	33,974	72.0	13,232	28.0	47,206
1973	37,000	70.6	15,403	29.4	52,403	34,738	71.6	13,761	28.4	48,499
1974	37,000	68.8	16,773	31.2	53,773	35,520	71.3	14,311	28.7	49,831
1975	37,000	67.1	18,182	32.9	55,182	36,319	70.9	14,883	29.1	51,202
1976	37,000	65.5	19,464	34.5	56,464	37,000	70.4	15,523	29.6	52,523
1977	37,000	64.0	20,777	36.0	57,777	37,000	68.7	16,883	31.3	53,883
1978	37,000	62.6	22,124	37.4	59,124	37,000	66.9	18,283	33.1	55,283
1979	37,000	61.2	23,504	38.8	60,504	37,000	65.2	19,724	34.8	56,724
1980	37,000	59.8	24,918	40.2	61,918	37,000	63.6	21,206	36.4	58,206
1981	37,000	58.6	26,177	41.4	63,177	37,000	62.0	22,632	38.0	59,632
1982	37,000	57.4	27,464	42.6	64,464	37,000	60.6	24,099	39.4	61,099
1983	37,000	56.2	28,778	43.8	65,778	37,000	59.1	25,609	40.9	62,609
1984	37,000	55.1	30,122	44.9	67,122	37,000	57.7	27,163	42.3	64,163
1985	37,000	54.0	31,494	46.0	68,494	37,000	56.3	28,762	43.7	65,762
1986	37,000	52.9	32,897	47.1	69,897	37,000	54.9	30,408	45.1	67,408
1987	37,000	52.9	33,000	47.1	70,000	37,000	53.5	32,103	46.5	69,103
1988	37,000	52.9	33,000	47.1	70,000	37,000	52.9	33,000	47.1	70,000
1989	37,000	52.9	33,000	47.1	70,000	37,000	52.9	33,000	47.1	70,000
1990	37,000	52.9	33,000	47.1	70,000	37,000	52.9	33,000	47.1	70,000

FIG. VIII-1

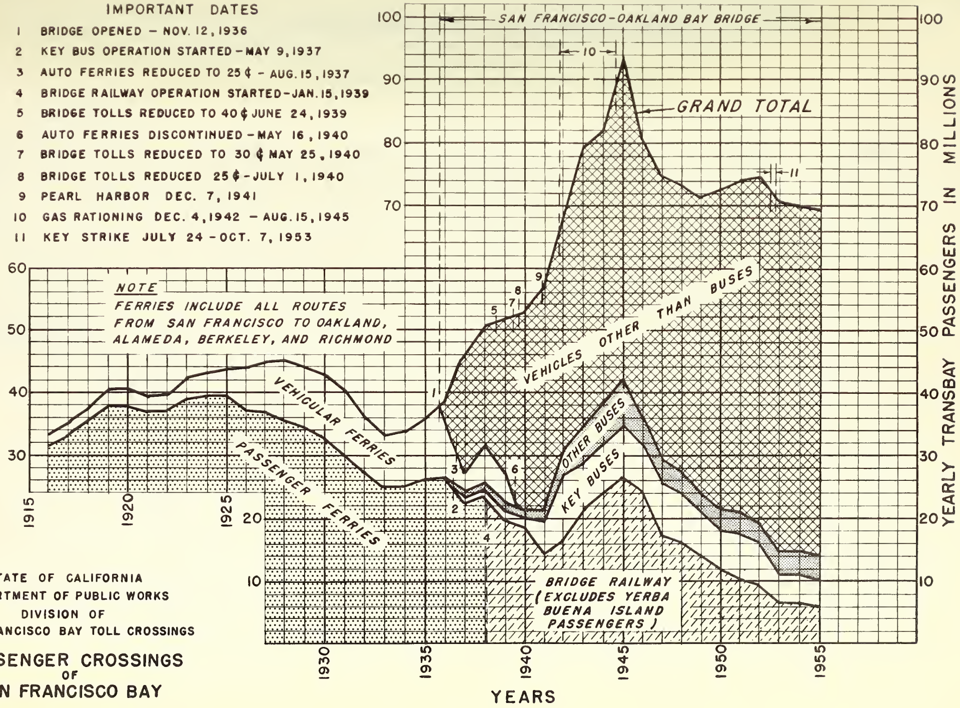


STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF SAN FRANCISCO BAY TOLL CROSSINGS

TOTAL MONTHLY VEHICULAR TRAFFIC
BAY AREA BRIDGES

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF
SAN FRANCISCO BAY TOLL CROSSINGS

PASSENGER CROSSINGS OF SAN FRANCISCO BAY



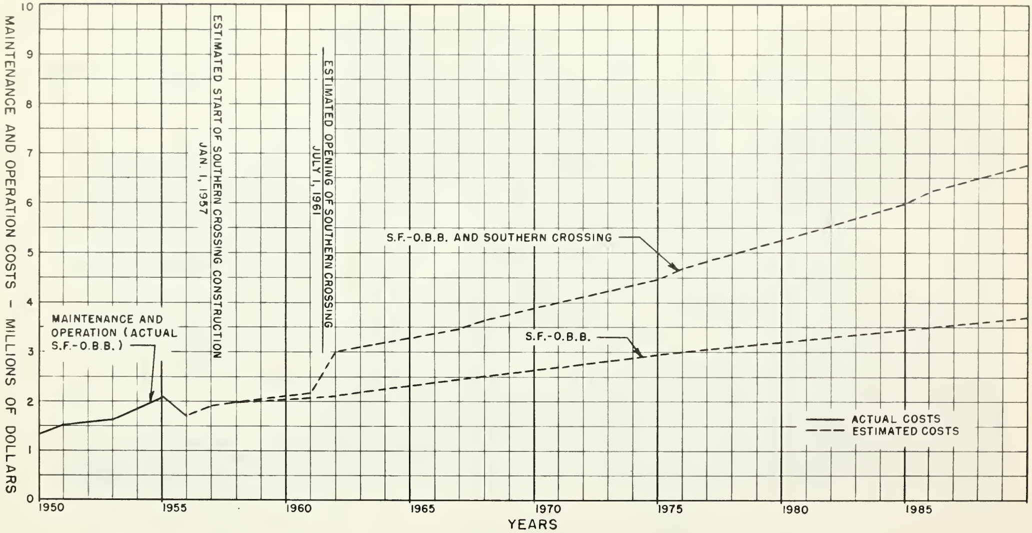
IMPORTANT DATES

1 BRIDGE OPENED – NOV. 12, 1936
2 KEY BUS OPERATION STARTED – MAY 9, 1937
3 AUTO FERRIES REDUCED TO 25¢ – AUG. 15, 1937
4 BRIDGE RAILWAY OPERATION STARTED – JAN. 15, 1939
5 BRIDGE TOLLS REDUCED TO 40¢ JUNE 24, 1939
6 AUTO FERRIES DISCONTINUED – MAY 16, 1940
7 BRIDGE TOLLS REDUCED TO 30¢ MAY 25, 1940
8 BRIDGE TOLLS REDUCED 25¢ – JULY 1, 1940
9 PEARL HARBOR DEC. 7, 1941
10 GAS RATIONING DEC. 4, 1942 – AUG. 15, 1945
11 KEY STRIKE JULY 24 – OCT. 7, 1953

NOTE
FERRIES INCLUDE ALL ROUTES FROM SAN FRANCISCO TO OAKLAND, ALAMEDA, BERKELEY, AND RICHMOND

SAN FRANCISCO – OAKLAND BAY BRIDGE
GRAND TOTAL
VEHICLES OTHER THAN BUSES
OTHER BUSES
KEY BUSES
BRIDGE RAILWAY (EXCLUDES YERBA BUENA ISLAND PASSENGERS)
VEHICULAR FERRIES
PASSENGER FERRIES
1
2
3
4
5
6
7
8
9
10
11
YEARLY TRANSBAY PASSENGERS IN MILLIONS
100
90
80
70
60
50
40
30
20
10
YEARS
1915
1920
1925
1930
1935
1940
1945
1950
1955

FIG. VIII-3

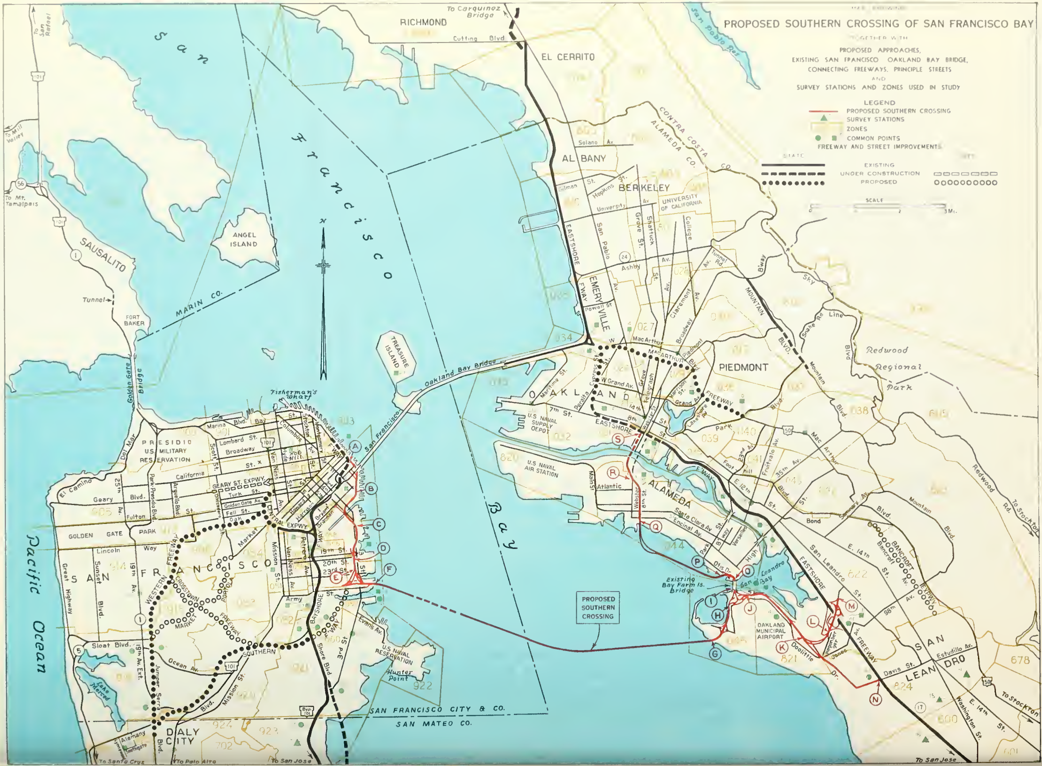


STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF SAN FRANCISCO BAY TOLL CROSSINGS

SOUTHERN CROSSING

MAINTENANCE AND OPERATION COSTS

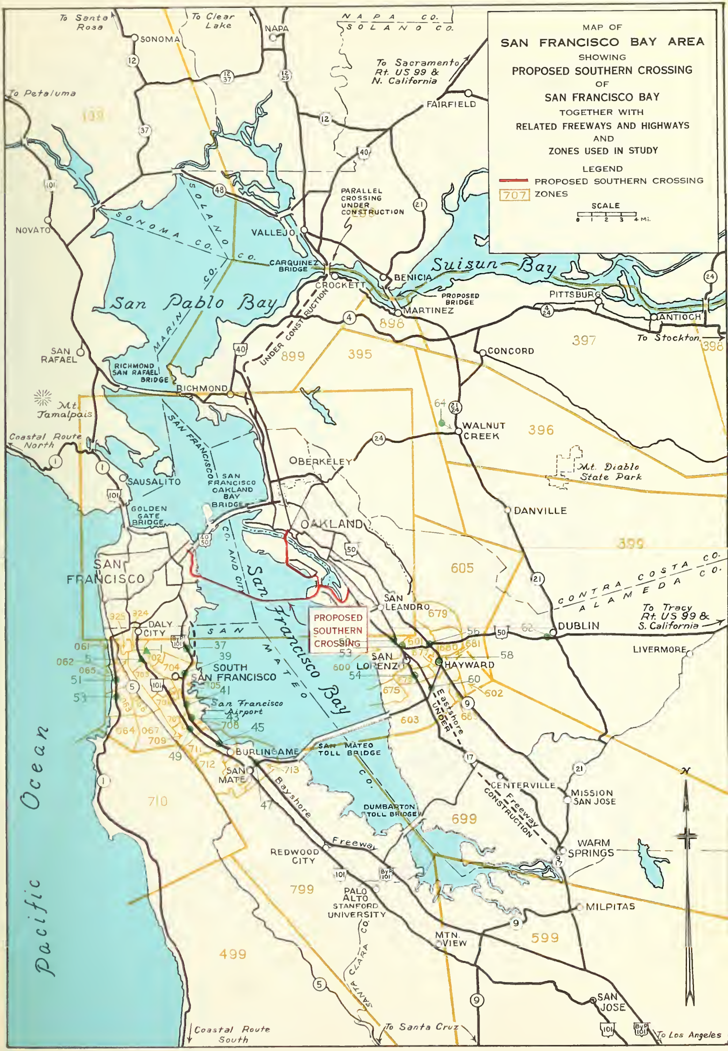
FIGURE VIII 4



PROPOSED SOUTHERN CROSSING OF SAN FRANCISCO BAY

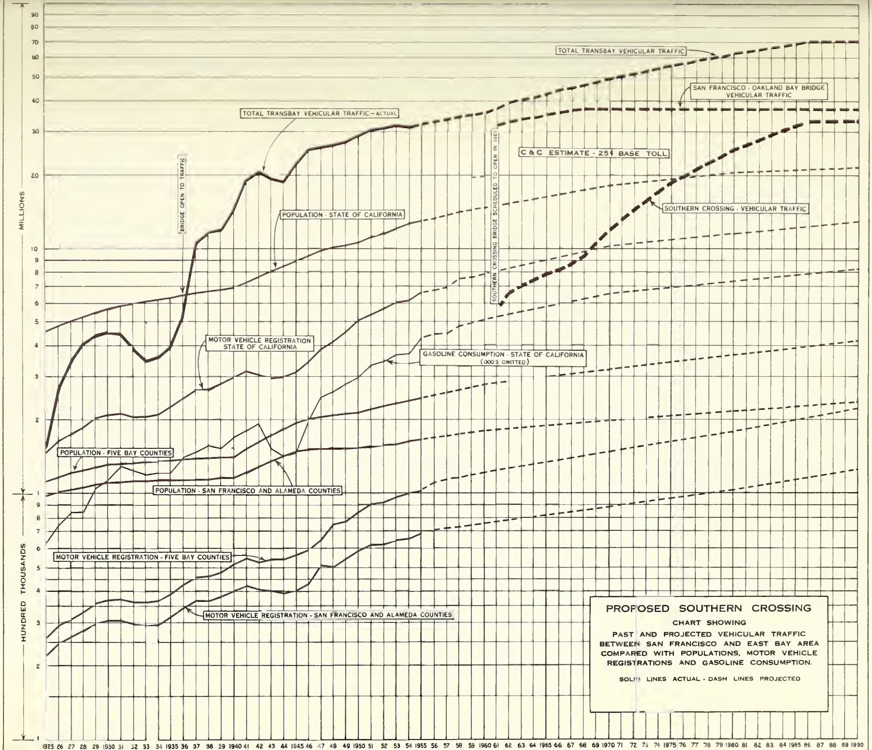
TOGETHER WITH

PROPOSED APPROACHES,
EXISTING SAN FRANCISCO OAKLAND BAY BRIDGE,
CONNECTING FREEWAYS, PRINCIPLE STREETS
AND
SURVEY STATIONS AND ZONES USED IN STUDY



MAP OF
SAN FRANCISCO BAY AREA
SHOWING
PROPOSED SOUTHERN CROSSING
OF
SAN FRANCISCO BAY
TOGETHER WITH
RELATED FREEWAYS AND HIGHWAYS
AND
ZONES USED IN STUDY

FIGURE VIII



PROPOSED SOUTHERN CROSSING

CHART SHOWING

PAST AND PROJECTED VEHICULAR TRAFFIC BETWEEN SAN FRANCISCO AND EAST BAY AREA COMPARED WITH POPULATIONS, MOTOR VEHICLE REGISTRATIONS AND GASOLINE CONSUMPTION.

SOLID LINES ACTUAL - DASH LINES PROJECTED

FIGURE VIII - 6

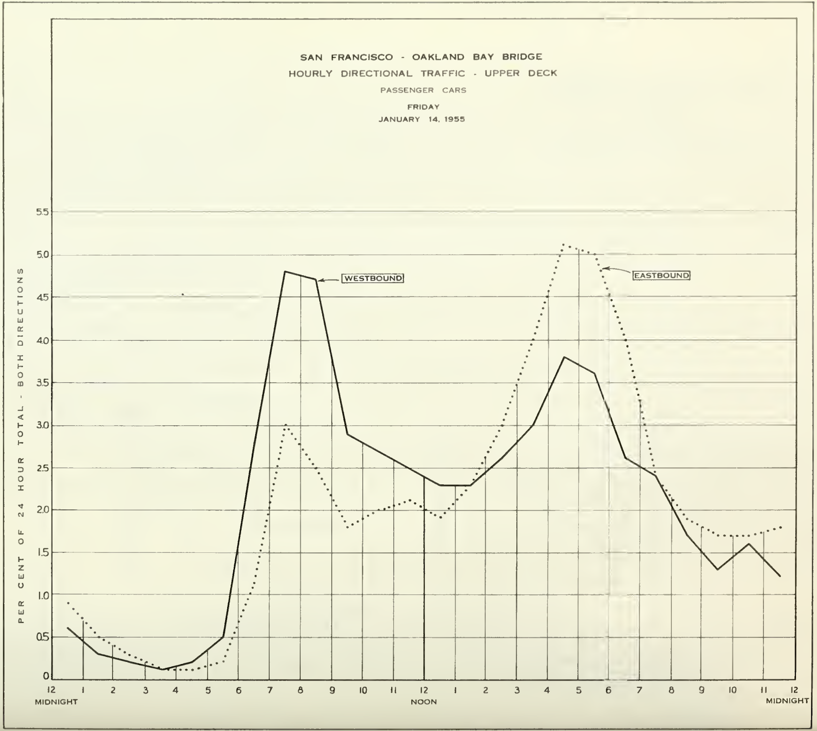

SAN FRANCISCO - OAKLAND BAY BRIDGE
HOURLY DIRECTIONAL TRAFFIC - UPPER DECK
PASSENGER CARS
FRIDAY
JANUARY 14, 1955

FIGURE VIII - 7

SAN FRANCISCO - OAKLAND BAY BRIDGE
HOURLY DIRECTIONAL TRAFFIC - LOWER DECK
PASSENGER CARS, TRUCKS AND BUSES
FRIDAY
JANUARY 14, 1955

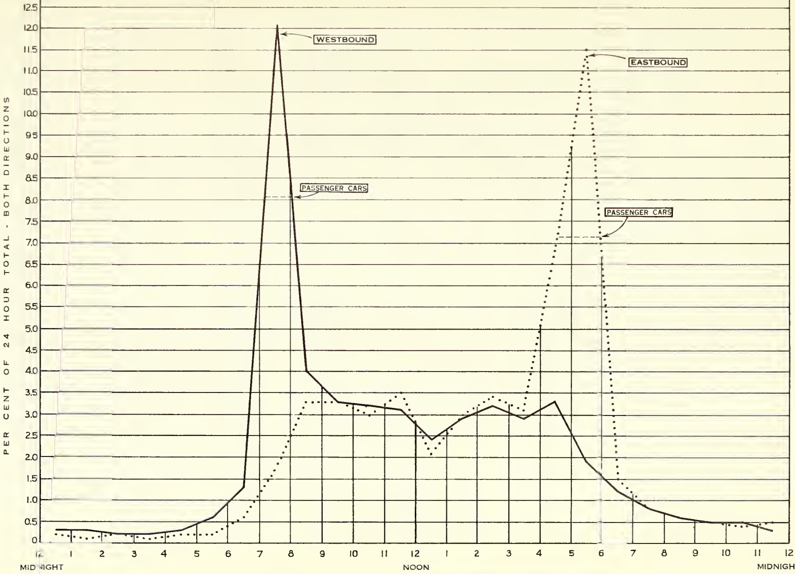
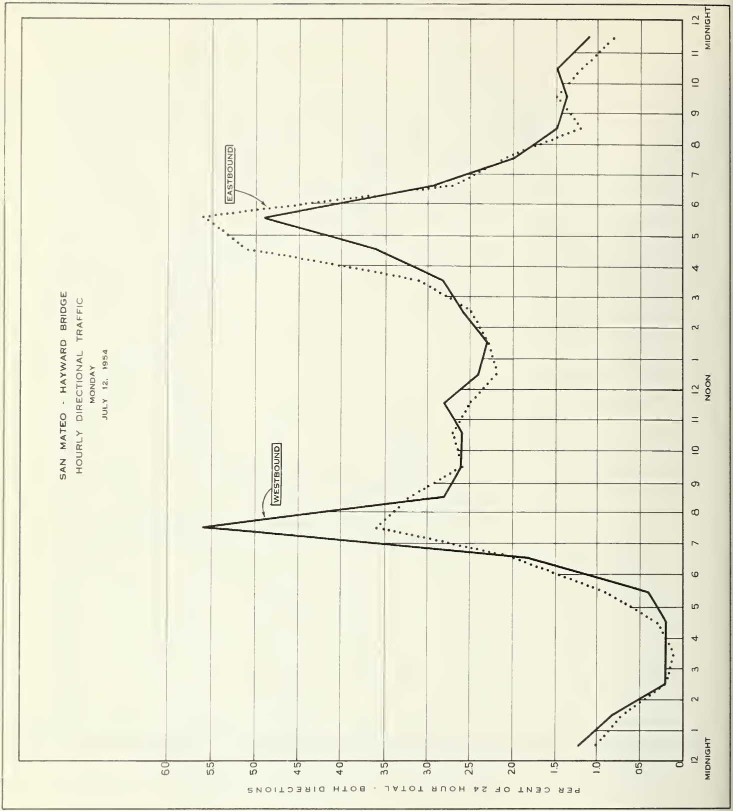


FIGURE VIII - 8



SAN MATEO - HAYWARD BRIDGE
HOURLY DIRECTIONAL TRAFFIC
MONDAY
JULY 12, 1954

PART IX

CONCLUSIONS

This report is intended to supplement and to supersede, in part, the Southern Crossing Report of December 1955. The project description; cost, traffic, and revenue estimates; and proposed financing and construction schedules have been revised as a result of amending legislation enacted in 1956. Certain conclusions presented in the previous report are restated as follows:

1. The entire project is feasible from an engineering and construction standpoint.
2. Contract plans and specifications for the Bay Tube and Fills will be completed, and bids could be received by the end of 1956.
3. Contingent upon receiving favorable bids for construction of the Bay Tube and Fills and upon the successful sale of revenue bonds, project construction could start early in 1957.
4. Construction of the initial project as presented on Figure IX-1, and of the entire project as presented on Figure IX-3, could be completed in an estimated 4-1/2 years and 5-1/2 years, respectively.
5. The entire project, as described by the Statutes and reported on herein, could be financed with an automobile toll of 35 cents on the Southern Crossing and a toll increase to 35 cents on the Bay Bridge at the time the Southern Crossing is opened to traffic.
6. The project is adaptable to stage construction; after completion of the transbay section, minimum approach connections, and the Webster Street Tube, other portions of the approaches could then be built as required to serve traffic.

Table IX-2

Deleted from this report.
(Construction based on 30-cent toll)

FIG. IX-1

SAN FRANCISCO APPROACHES

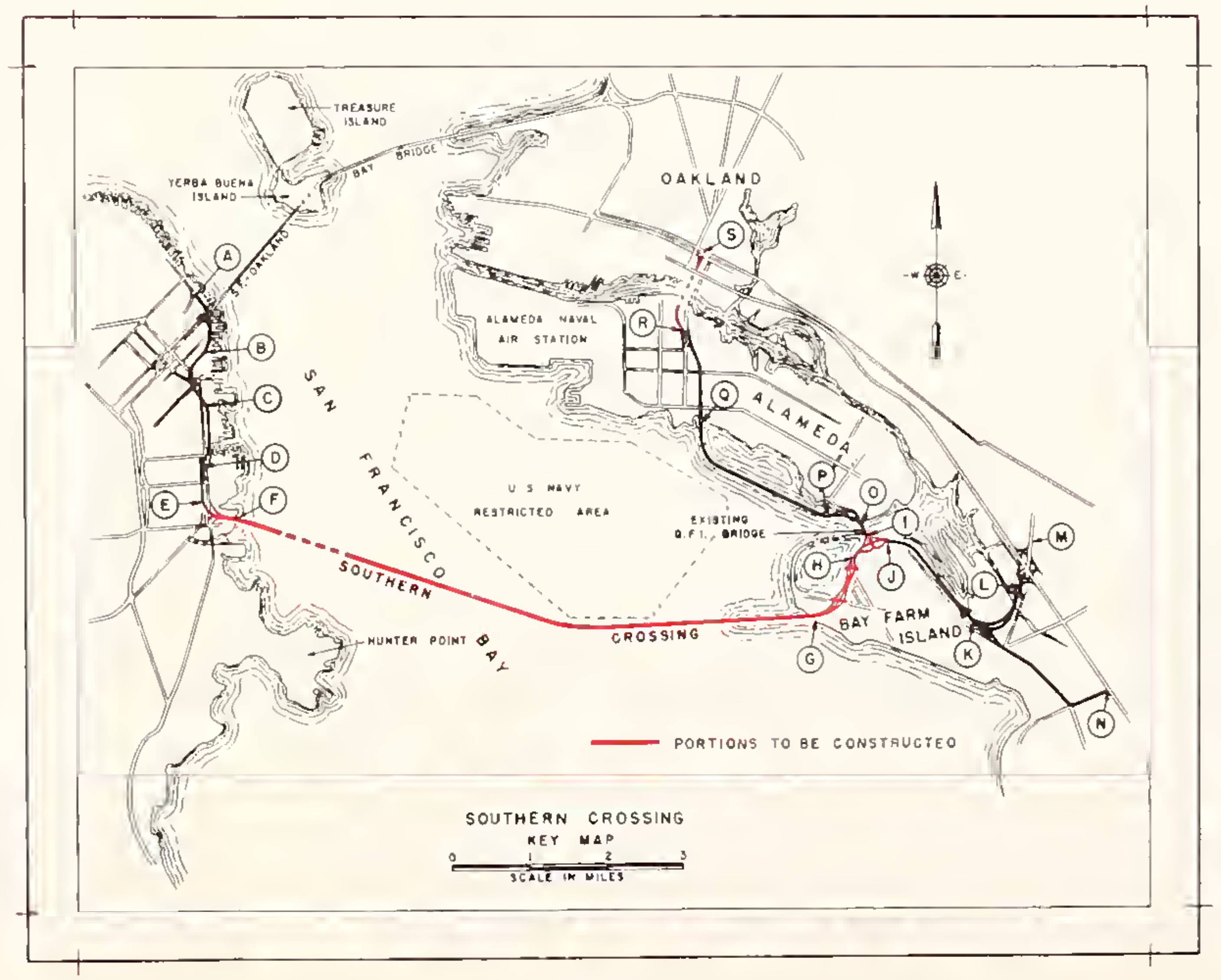
CONTRACT NUMBER	SECTION	SUB-SECTION	ESTIMATED COST - THOUSANDS OF DOLLARS: CONTRACT	R/W	SUBTOTAL	TOTAL
2009 EMBARCADERO APPROACH	A to B	FREEWAY VIADUCT HOWARD TO TOWNSEND ST. VIA THE EMBARCADERO				
		SPEAR ST. ON-RAMP				
		MAIN ST. OFF-RAMP				
	SUBTOTAL	A to B				
	B to C	FREEWAY VIADUCT VIA TOWNSEND ST.				
		FREEWAY VIADUCT VIA FOURTH STREET				
		THIRD ST. OFF-RAMP				
		FOURTH ST. ON-RAMP				
	SUBTOTAL	B to C				
	C to D	FREEWAY VIADUCT FOURTH TO NINETEENTH ST. VIA THIRD ST.				
		EIGHTEENTH ST. ON-RAMP NORTHBOUND				
	SUBTOTAL	C to D				
	D to E	FREEWAY VIADUCT NINETEENTH TO TWENTY-THIRD ST. VIA TENNESSEE ST.				
		MARIPOSA ST. ON-RAMP SOUTHBOUND				
		NINETEENTH ST. OFF-RAMP NORTHBOUND				
		TWENTY-SECOND ST. OFF-RAMP SOUTHBOUND				
	SUBTOTAL	D to E				
	E to F	THIRD AND ARMY INTERCHANGE	5,530	2,150	7,680	
		TWENTY-THIRD ST. ON- AND OFF-RAMPS	540	300	840	
		ARMY STREET ON- AND OFF-RAMPS	430	120	550	
	SUBTOTAL	E to F				9,070
TOTAL COST - SAN FRANCISCO APPROACHES						9,070

TRANSBAY CROSSING

CONTRACT NUMBER	SECTION	CONTRACT TITLE	ESTIMATED COST - THOUSANDS OF DOLLARS: CONTRACT	R/W	SUBTOTAL	TOTAL
2001	F to G	FOUNDATION EXPLORATIONS	420	00	420	
2002		BAY TUBE AND FILLS	109,650	100	109,750	
2004		TUBE FINISHING	500	00	500	
2005		BAY TRESTLE	29,970	00	29,970	
2013		BUILDINGS AND TOLL PLAZA	2,540	00	2,540	
2017		PAVING	640	00	640	
2018		ELECTRICAL WORK	4,220	00	4,220	
2019		MECHANICAL WORK	1,480	00	1,480	
2023		TOLL COLLECTION EQUIPMENT	640	00	640	
TOTAL COST - TRANSBAY CROSSING						150,160

EASTBAY APPROACHES

CONTRACT NUMBER	SECTION	SUB-SECTION	ESTIMATED COST - THOUSANDS OF DOLLARS: CONTRACT	R/W	SUBTOTAL	TOTAL
2014 EASTSHORE FREEWAY APPROACH	G to H	BAY FARM ISLAND FREEWAY WITH TWO INTERCHANGES	2,430	220	2,650	
	H to I to J	BAY FARM ISLAND INTERCHANGE	1,180	480	1,660	
	J to K	SAN LEANDRO BAY FREEWAY AND AIRPORT INTERCHANGE				
	K to L	SAN LEANDRO BAY FREEWAY AND HEGENBERGER RD. U.C.				
	L to M	HEGENBERGER - EASTSHORE FREEWAY INTERCHANGE				
	K to N	DOOLITTLE-DAVIS HIGHWAY CONNECTION				
	SUBTOTAL	G to N				4,310
2012 ALAMEDA APPROACH	O to P	OTIS DRIVE INTERCHANGE				
	P to Q	SOUTHSHORE HIGHWAY				
	O to R	EIGHTH STREET HIGHWAY				
		WEBSTER STREET INTERCHANGE				
	SUBTOTAL	O to R				
2003 WEBSTER ST. TUBE	R to S	WEBSTER ST. TUBE AND RAMPS	16,940	3,020		19,960
TOTAL COST - EASTBAY APPROACHES						24,270



SOUTHERN CROSSING
KEY MAP

NOTES

1. CONTRACT COST INCLUDES CONSTRUCTION COST, CONSTRUCTION CONTINGENCY COST AND OVERHEAD COST.
2. RIGHT-OF-WAY COST INCLUDES UTILITY RELOCATION COSTS.
3. COSTS OF CONTRACTS NO. 2007, RAILROAD RELOCATION, NO. 2020, TRAFFIC STRIPES AND SIGNS, AND NO. 2022, LANDSCAPING ARE INCLUDED IN OTHER CONTRACTS WHERE APPLICABLE.

SUMMARY

	CONTRACT COST: CONSTRUCTION	CONTINGENCY	OVERHEAD	RIGHT OF WAY COST	TOTAL COST
SAN FRANCISCO APPROACHES	$ 5,360,000	$ 540,000	$ 600,000	$ 2,570,000	$ 9,070,000
TRANSBAY CROSSING	128,460,000	12,860,000	8,740,000	100,000	150,160,000
EASTBAY APPROACHES	16,980,000	1,700,000	1,870,000	3,720,000	24,270,000
TOTAL					$ 183,500,000

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF SAN FRANCISCO BAY TOLL CROSSINGS

SOUTHERN CROSSING

CONSTRUCTION BASED ON 25 CENT TOLL

Figure IX-2

Deleted from this report.
(Case II of December 1955 Report)

FIG. IX-3

SAN FRANCISCO APPROACHES

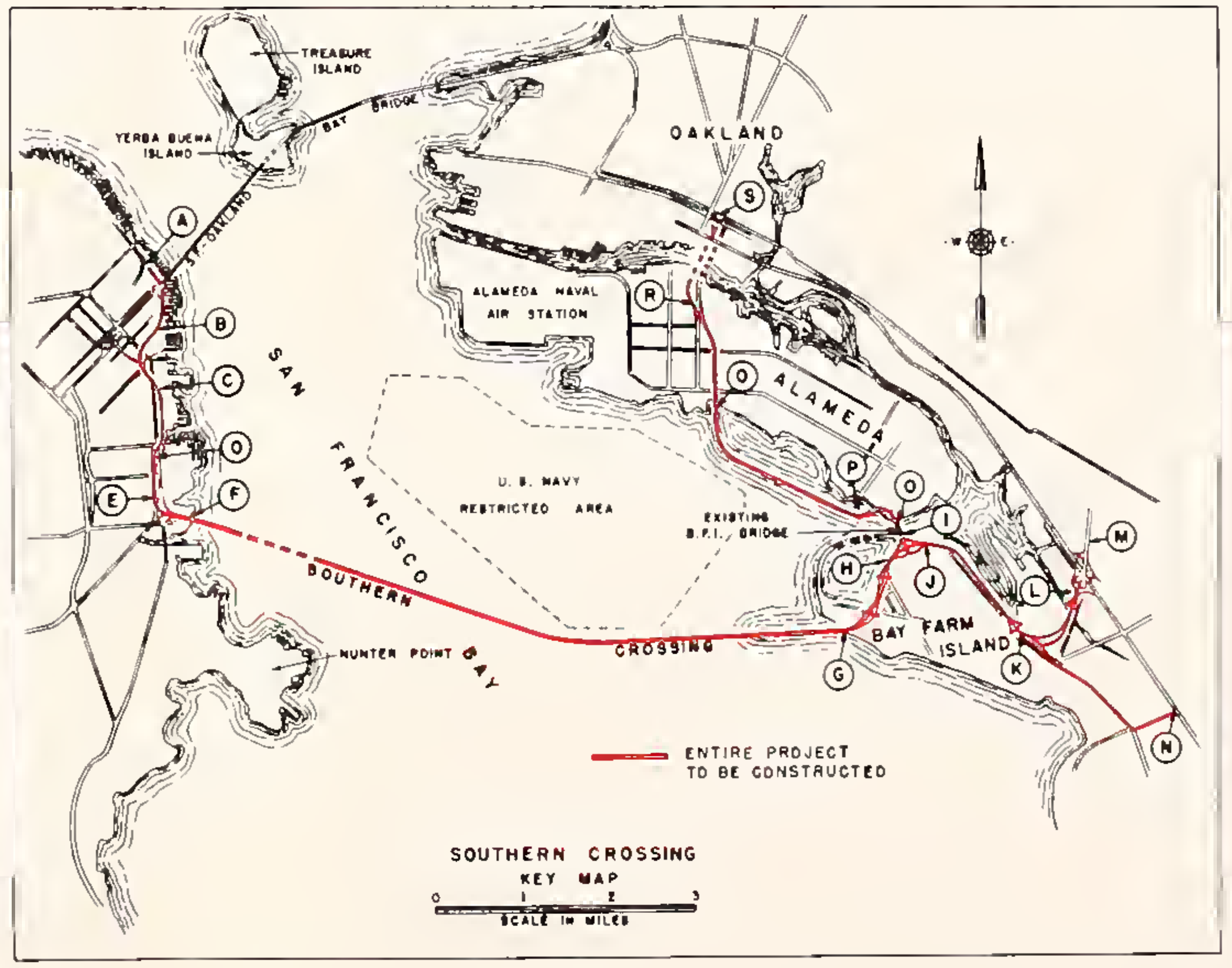
CONTRACT NUMBER	SECTION	SUB-SECTION	ESTIMATED COST - THOUSANDS OF DOLLARS			
			CONTRACT	R/W	SUBTOTAL	TOTAL
2009 EMBARCADERO APPROACH	A to B	FREEWAY VIADUCT HOWARD TO TOWNSEND ST. VIA THE EMBARCADERO	5,850	00	5,850	
		SPEAR ST. ON-RAMP	350	350	700	
		MAIN ST. OFF-RAMP	520	350	870	
	SUBTOTAL	A to B				7,420
	B to C	FREEWAY VIADUCT VIA TOWNSEND ST.	4,530	630	5,160	
		FREEWAY VIADUCT VIA FOURTH STREET	2,460	100	2,560	
		THIRD ST. OFF-RAMP	550	420	970	
		FOURTH ST. ON-RAMP	650	940	1,590	
	SUBTOTAL	B to C				10,280
	C to D	FREEWAY VIADUCT FOURTH TO NINETEENTH ST. VIA THIRD ST.	6,380	1,290	7,670	
		EIGHTEENTH ST. ON-RAMP NORTHBOUND	240	130	370	
	SUBTOTAL	C to D				8,040
	D to E	FREEWAY VIADUCT NINETEENTH TO TWENTY-THIRD ST. VIA TENNESSEE ST.	3,920	1,260	5,180	
		MARIPOSA ST. ON-RAMP SOUTHBOUND	390	320	710	
		NINETEENTH ST. OFF-RAMP NORTHBOUND	300	240	540	
		TWENTY-SECOND ST. OFF-RAMP SOUTHBOUND	340	270	610	
	SUBTOTAL	D to E				7,040
	E to F	THIRD AND ARMY INTERCHANGE	6,180	2,150	8,330	
		TWENTY-THIRD ST. ON- AND OFF-RAMPS	540	300	840	
		ARMY STREET ON- AND OFF-RAMPS	430	120	550	
	SUBTOTAL	E to F				9,720
TOTAL COST - SAN FRANCISCO APPROACHES						42,500

NOTES

1. CONTRACT COST INCLUDES CONSTRUCTION COST, CONSTRUCTION CONTINGENCY COST AND OVERHEAD COST.
2. RIGHT-OF-WAY COST INCLUDES UTILITY RELOCATION COSTS.
3. COSTS OF CONTRACTS NO. 2007, RAILROAD RELOCATIOR, NO. 2020, TRAFFIC STRIPES AND SIGNS, AND NO. 2022, LANDSCAPING ARE INCLUDED IN OTHER CONTRACTS WHERE APPLICABLE.

TRANSBAY CROSSING

CONTRACT NUMBER	SECTION	CONTRACT TITLE	ESTIMATED COST - THOUSANDS OF DOLLARS			
			CONTRACT	R/W	SUBTOTAL	TOTAL
2001	F to G	FOUNDATION EXPLORATIONS	420	00	420	
2002		BAY TUBE AND FILLS	109,650	100	109,750	
2004		TUBE FINISHING	500	00	500	
2005		BAY TRESTLE	29,970	00	29,970	
2013		BUILDINGS AND TOLL PLAZA	2,540	00	2,540	
2017		PAVING	640	00	640	
2018		ELECTRICAL WORK	4,220	00	4,220	
2019		MECHANICAL WORK	1,480	00	1,480	
2023		TOLL COLLECTION EQUIPMENT	640	00	640	
TOTAL COST - TRANSBAY CROSSING						150,160



SOUTHERN CROSSING
KEY MAP

EASTBAY APPROACHES

CONTRACT NUMBER	SECTION	SUB-SECTION	ESTIMATED COST - THOUSANDS OF DOLLARS			
			CONTRACT	R/W	SUBTOTAL	TOTAL
2014 EASTSHORE FREEWAY APPROACH	G to H	BAY FARM ISLAND FREEWAY WITH TWO INTERCHANGES	2,430	220	2,650	
	H to I to J	BAY FARM ISLAND INTERCHANGE	1,180	480	1,660	
	J to K	SAN LEANDRO BAY FREEWAY AND AIRPORT INTERCHANGE	3,020	450	3,470	
	K to L	SAN LEANDRO BAY FREEWAY AND HEGENBERGER RD. U.C.	2,940	510	3,450	
	L to M	HEGENBERGER - EASTSHORE FREEWAY INTERCHANGE	350	90	440	
	K to N	DOOLITTLE-DAVIS HIGHWAY CONNECTION	3000	400	3400	
	SUBTOTAL	G to N				15,070
2012 ALAMEDA APPROACH	O to P	OTIS DRIVE INTERCHANGE	970	790	1,760	
	P to Q	SOUTHSHORE HIGHWAY	2,020	30	2,050	
	O to R	EIGHTH STREET HIGHWAY	1,250	530	1,780	
		WEBSTER STREET INTERCHANGE	1,910	510	2,420	
	SUBTOTAL	O to R				8,010
2003 WEBSTER ST. TUBE	R to S	WEBSTER ST. TUBE AND RAMPS	16,940	3,020		19,960
TOTAL COST - EASTBAY APPROACHES						43,040

SUMMARY

	CONTRACT COST			RIGHT OF WAY COST	TOTAL COST
	CONSTRUCTION	CONTINGENCY	OVERHEAD		
SAN FRANCISCO APPROACHES	$ 27,800,000	$ 2,760,000	$ 3,070,000	$ 8,870,000	$ 42,500,000
TRANSBAY CROSSING	128,460,000	12,860,000	8,740,000	100,000	150,160,000
EASTBAY APPROACHES	29,740,000	3,020,000	3,250,000	7,030,000	43,040,000
TOTAL					$ 235,700,000

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF SAN FRANCISCO BAY TOLL CROSSINGS

SOUTHERN CROSSING

CONSTRUCTION BASED ON 35 CENT TOLL

APPENDIX A

STREETS AND HIGHWAYS CODE

(Amendments and additions enacted by
Chapter 1056, Statutes 1953,
Chapter 304, Statutes 1955,
Chapter 40, Statutes 1956,
and Chapter 67, Statutes 1956.)

Division 1. State Highways

Chapter 1. Administration

Article 3. The Department of Public Works

100.7. The department may, for the protection of the State of California, insure any bridge on the State Highway System acquired or constructed under provisions of the California Toll Bridge Authority Act against all risks in any amount up to the full insurable value thereof. In case of damage or destruction, the proceeds of such insurance shall be applied to the restoration of such bridge. Any such bridge may be so insured irrespective of the retirement of all indebtedness incurred for its acquisition or construction, and the cost of such insurance shall be paid from any funds available to the department for highway purposes.

Any such bridge, other than bridges over the San Francisco Bay, shall, after retirement of all indebtedness incurred for its acquisition or construction, be maintained and operated as a free bridge and the cost thereof charged to funds available for maintenance of state Highways.

(Amended by Chapter 1056, Statutes 1953.)

Division 17. Toll Bridges, Toll Ferries, and Toll Roads

Chapter 1. The California Toll Bridge Authority Act

Article 7. Protection Against Competing Facilities

30350. As long as any of the bonds issued pursuant to this chapter for the acquisition, construction, enlargement, extension or change in design or structure of any toll bridge or other highway crossing are outstanding and unpaid, there shall not be erected, constructed or maintained any other bridge, subway, tunnel, or other crossing over, under, through, or across the waters over which such bridge or other highway crossing is located or constructed, connecting or adjoining directly or indirectly the lands or extensions thereof or abutments thereon on both sides of the waters spanned or crossed by such bridge or other highway crossing within a distance of 10 miles from either side of bridge or highway crossing, excepting bridges or other highway crossings actually in existence and being maintained, or for which there was outstanding an existing and lawfully issued franchise, at the time of the acquisition or location of the toll bridge or other highway crossing and prior to the time of the authorization of the revenue bonds.

Where a distance of less than 10 miles has been specified in any bond resolution containing the obligations of the authority in connection with any bonds theretofore issued, the department and the authority may construct new bridges or other highway crossings within less than 10 miles of the bridge or other highway crossing for which bonds are outstanding, but the provisions of any bond resolution adopted, prior to January 1, 1955, or similar provisions in any bond resolution thereafter adopted, in connection with the issuance of such bonds shall be observed. But, no such provisions shall prevent the construction of the Southern Crossing within eight miles of the San Mateo-Hayward Bridge.

(Amended by Chapter 304, Statutes 1955.)

30354.5 Neither the limitations nor the provisions of Section 30350, nor similar limitations of any other section of the California Toll Bridge Authority Act, shall apply to the acquisition, erection, construction, maintenance or operation of any rapid transit crossing exclusively for trains and not for passenger automobiles, trucks or busses, at any location within the San Francisco Bay between San Francisco and Alameda Counties.

(Added by Chapter 40, Statutes 1956.)

Chapter 2. Particular Highway Crossings

Article 1. San Francisco-Oakland Bay Bridge

30605. (a) The cost of operation and insurance of the toll bridge and any additional highway crossing of San Francisco Bay constructed between the County of Alameda and the City and County of San Francisco shall be paid by the department from the tolls and revenues received from the use and operation of the toll bridge and additional highway crossing. The cost of operation and insurance of any toll bridge or other highway crossing upon which tolls are now being collected or that may hereafter be acquired or constructed over the San Francisco Bay shall be paid by the department from the tolls and revenues received from the use and operation thereof.

(b) The cost of maintenance (exclusive of the approaches) of the toll bridge and any additional highway crossing of San Francisco Bay constructed between the County of Alameda and the City and County of San Francisco shall be paid by the department from the tolls and revenues received from the use and operation of the toll bridge and additional highway crossing, and the cost of maintenance (exclusive of the approaches) of any toll bridge or other highway crossing on which tolls are now being collected or that may hereafter be acquired or constructed over the San Francisco Bay, shall be paid by the department from the tolls and revenues received from the use and operation thereof, except as follows:

If the terms and conditions of any bonds that are outstanding on the effective date of this section and that are payable from such tolls are such as to require that the cost of physical maintenance of the toll bridge shall be paid from sources other than tolls and revenues from the use and operation of the toll bridge, the cost of such maintenance shall be paid by the department from money accruing and to accrue in the State Highway Fund available for the widening, resurfacing, and reconstruction of state highways for the group of counties designated as Group No. 1 in Section 187 until such bonds are refunded or retired or until payment of the cost of maintenance out of tolls and revenues from the toll bridge is authorized in the manner provided in the proceedings authorizing the issuance of such bonds. The State Highway Fund shall be reimbursed by the authority for all amounts so expended with interest thereon at the rate of one and one-half percent (1-1/2%) per annum to be computed on the total amount expended during any one year.

Whenever after the effective date of this section any bonds secured by pledge of the tolls and revenues of the toll bridge are refunded or retired, in the total then outstanding, the authority shall include in the proceedings for any new issue of bonds for such purpose bonds in a sufficient amount to repay to the State Highway Fund the amount provided by this section. If the amount is not repaid from the proceeds from the sale of bonds and all revenue bonds secured by revenues on the toll bridge are fully retired, and all other obligations secured by revenues of the toll bridge, whether by means of bond issue or other provisions of law have been fully paid, then such repayment shall be made from the tolls and revenues of the toll bridge, and the authority and the department shall fix and collect tolls on the toll bridge at a rate sufficient to include provision for such repayment until the amount required to be paid into the State Highway Fund by this section has been paid thereto.

The moneys required to be repaid by this section shall be credited to the money available for construction of state highways in County Group No. 1 as specified in Section 187.

(Repealed and added by Chapter 1056, Statutes 1953.)

30606. (Repealed by Chapter 1056, Statutes 1953.)

30607. There shall be repaid into the State Highway Fund the total amount expended therefrom prior to the effective date of this section for maintenance, operation, and insurance of the toll bridge, which amount shall be determined by the department and the authority.

Whenever, after the effective date of this section, any bonds secured by a pledge of the tolls and revenues of the toll bridge are refunded or retired, in the total then outstanding, the California Toll Bridge Authority shall include in the proceedings for any new issue of bonds for such purpose bonds in an amount fully sufficient to repay to the State Highway Fund the amount provided by this section.

If the amount provided to be repaid to the State Highway Fund by this section is not repaid from the proceeds of the sale of bonds, then, after all revenue bonds issued and sold by the California Toll Bridge Aughority in the sum of twenty-one million dollars ($21,000,000) and designated as "San Francisco-Oakland Bay Bridge 1951 Refunding and Improvement Toll Bridge Revenue Bonds, Series A" have been fully redeemed and paid, the authority and the department shall fix and collect tolls on the toll bridge at a rate sufficient to include provision for such repayment until the amount required to be paid into the State Highway Fund by this section has been collected to make such payment.

The moneys required to be repaid by this section shall be credited to the money available for construction of state highways in County Group No. 1 as specified in Section 187.

(Repealed and added by Chapter 1056, Statutes 1953.)

30608. Pending the issuance and sale of bonds secured by the tolls of the San Francisco-Oakland Bay Bridge for the financing of the Southern Crossing specified in Article 2 of this chapter, the authority shall continue to fix and the department shall collect tolls at substantially the same rates as in effect January 1, 1955. Revenues therefrom shall continue to be devoted to fulfilling any obligations of the authority pursuant to any bond indenture or statute in effect on said date, and any surplus revenues shall be held and invested as authorized by law for assistance in the financing of the Southern Crossing or such other purpose as may be authorized or provided by law.

(Repealed by Chapter 1056, Statutes 1953, and
added by Chapter 304, Statutes 1955.)

Article 2. Southern Bay Crossing

(Article 2 added to Chapter 2, Division 17, Streets and Highways Code, by Chapter 1056, Statutes 1953, and amended by Chapter 304, Statutes 1955, and Chapter 67, Statutes 1956.)

30651. (a) As used in this article, "toll bridge" means that certain bridge across San Francisco Bay known as the San Francisco-Oakland Bay Bridge and the approaches thereto.

(b) As used in this article, "southern crossing" means an additional toll bridge or other highway crossing, as provided by this article and by Chapter 1 of this Division, across San Francisco Bay from the City and County of San Francisco to the County of Alameda, and including the approaches thereto.

30652. As soon after the effective date of this section as it may lawfully do so under federal law, the California Toll Bridge Authority shall issue bonds in a sufficient amount to pay or provide for the payment of engineering studies, plans, and specifications of an additional bridge or other highway crossing across San Francisco Bay to relieve congestion of traffic on the toll bridge and to reimburse the State for such engineering expenses as have theretofore been incurred by it for that purpose, which additional bridge or other highway crossing is designated the Southern Crossing. Subject to the provisions of the bond resolution, the proceeds of any bonds issued prior to January 1, 1954, may be used for the payment of all engineering, traffic, and financial studies and expenses in connection with the financing and construction of the Southern Crossing. The authority may issue such additional bonds as are necessary to complete the engineering, plans, specifications, estimates of cost, and all other studies necessary to assure the financing and construction of the Southern Crossing. After the completion of a report including an estimate of costs of financing and constructing the Southern Crossing and its approaches as described in this article, the department may use any funds available to it from the proceeds of any bonds issued under this article by the authority for the additional purpose of studying revisions in the approach system as described and outlined in the Assembly Journal for March 23, 1955, at page 1704.

(Amended by Chapter 304, Statutes 1955.)

30653. (a) The authority and the department shall apply promptly to the appropriate officials of the Federal Government for permission to construct a southern crossing having its westerly terminus in the vicinity of Army and Third Streets in the City and County of San Francisco and its easterly terminus on Bay Farm Island, and shall obtain the necessary permits therefor as promptly as feasible.

(b) If permission to construct the southern crossing at the location specified in subdivision (a) of this section cannot be obtained, the authority and the department shall forthwith determine the most feasible location of the southern crossing and type of construction thereof, located southerly from the toll bridge and having its westerly terminus between the southern city limits and Army Street in the City and County of San Francisco and its easterly terminus on Bay Farm Island, and shall promptly confer with the appropriate officials of the Federal Government from whom permits must be obtained for the construction of such bridge or other highway crossing and shall obtain such permits as promptly as feasible.

30654. The westerly terminus of the Southern Crossing shall be in the vicinity of Third and Army Streets, and the westerly approaches shall include:

(a) A six-lane freeway connection between Army Street and the Embarcadero Freeway in the vicinity of Mission Street along the approximate route of Tennessee Street, Third Street, Fourth Street, Townsend Street, and the Embarcadero with on-and-off ramp connections to city streets in the vicinity of Army Street, on-and-off ramp connections in the vicinity of 23d Street, two on-ramp and two off-ramp connections in the vicinity of Third Street between 16th Street and 22d Street, an off-ramp connection in the vicinity of Main and Harrison Streets, an on-ramp connection in the vicinity of Spear and Harrison Streets, an on-ramp connection in the vicinity of Fourth and Brannan Streets, an off-ramp connection in the vicinity of Third Street and Channel Street.

(b) Direct connections between the Southern Crossing, the freeway connection described in subdivision (a), and the southern freeway of the City and County of San Francisco.

If the easterly terminus of the Southern Crossing is on Bay Farm Island at or in the vicinity of a point on the southwesterly shore thereof south of the intersection of Kilkenny Road and the county road connecting Bay Farm Island with the City of Alameda, the easterly approaches shall include:

(a) A freeway crossing Bay Farm Island to the bridge connecting the island with the City of Alameda, with on-and-off ramps in both directions, the first set of such ramps to be located in the vicinity of the intersection of Maitland Drive and County Road and the other set of ramps between the first set and the easterly terminus of the Southern Crossing. The freeway through Bay Farm Island northerly of Mecartney Road shall be contiguous to both Maitland Drive and County Road.

(b) A freeway from a point on the Bay Farm Island Freeway to the intersection of Eastshore Freeway and Hegenberger Road and a highway from such freeway in the vicinity of Hegenberger Road and Doolittle Drive along Doolittle Drive to Davis Street and thence northerly along Davis Street to the intersection of Eastshore Freeway.

(c) A connection from Bay Farm Island to a point on the southerly shore of the City of Alameda and a highway along the southerly shore of the City of Alameda from such point to a southerly prolongation of Eighth Street, thence northerly along Eighth Street to a point near Lincoln Avenue, thence along the Southern Pacific right of way to Atlantic Avenue, and thence to the Posey Tube connecting the City of Alameda and the City of Oakland and a parallel tube which shall be constructed as part of the approaches, with on-and-off ramps in both directions in the vicinity of the north end of the bridge connecting to Bay Farm Island, and with adequate on-and-off ramps connecting the freeway and tubes with the streets in the Cities of Oakland and Alameda and an interchange in the vicinity of Atlantic Avenue and Webster Street in the City of Alameda.

The tube parallel to the Posey Tube connecting the City of Alameda with the City of Oakland at Webster Street, and the approaches to the parallel tubes shall be constructed immediately as soon as money is obtained that may be used therefor either through the sale of revenue bonds the proceeds of which may be used for such purpose or through the refinancing by the Reconstruction Finance Corporation or any other agency.

(Amended by Chapter 304, Statutes 1955, and
Chapter 67, Statutes 1956.)

30654.5. In the event that any of the approaches specified in Section 30654 involve crossings of property for which federal authorization is necessary and the necessary authorizations cannot be obtained from the appropriate officials of the Federal Government, the authority and the department shall promptly determine appropriate substitutions or revisions in the system of approaches, except that the portion of the free-way described in subdivision (c) of Section 30654 along the line of Main Street shall not be moved easterly more than 900 feet.

(Added by Chapter 304, Statutes 1955.)

30655. If the terminal points of the southern crossing differ substantially from those set forth in Section 30654, the authority and the department shall promptly determine appropriate approaches thereto as soon as its location and type of construction are determined to provide suitable connection with Bayshore Freeway and if necessary the construction of portions of such freeway and other connections to the main arterial routes in the city and county of San Francisco. It shall likewise determine appropriate approaches in Alameda County, including connections with the easterly terminus of such bridge or other crossing with the Eastshore Freeway at one or more points, and including an additional tube connecting the City of Alameda and the City of Oakland under the Oakland Estuary with suitable connections on each end of said tube. In connection with the location of the approaches to the bridge or other highway crossing to be constructed, the authority shall advise the governing bodies of the City and County of San Francisco, the County of Alameda, and all of the cities in the County of Alameda, as to the approaches it deems appropriate, and upon the request of any such governmental agencies shall hold public hearings concerning the location of said approaches before they are finally determined by the authority.

30656. As soon as surveys, plans, specifications and estimates of cost are completed for the southern crossing and the approaches thereto and the project has qualified for immediate construction under any governmental restrictions then in effect, the authority shall undertake the financing and construction of the southern crossing and the approaches as promptly as possible and without unnecessary delay, except that no construction shall be commenced unless and until all restrictions in the federal law imposing limitations upon the right of the State of California or the authority to collect tolls upon the existing San Francisco-Oakland Bay Bridge for the purpose of constructing a southern crossing of San Francisco Bay, or approaches leading to such crossing, have been deleted. The construction of the southern crossing, however, shall precede construction of any other such crossing.

It is hereby declared to be the intent of the Legislature that the construction of the southern crossing shall be commenced as soon as the federal law is amended so as to permit the collection of tolls upon the existing Bay Bridge for the purpose of constructing a southern crossing; but that this section is not intended to indicate a legislative declaration in favor of amending the federal law to permit collection of the existing bridge's tolls for construction of only one additional crossing, but rather that the Legislature favors amending the Federal law to permit collection of such tolls for construction of other crossings in addition to the southern crossing.

30657. The authority, to the extent that it finds it feasible to do so in connection with the financing of the Southern Crossing and the approaches thereto, shall include sufficient funds in any borrowing or issuance of bonds therefor to provide such amounts as will be necessary for the construction of the approaches mentioned in Section 30654 on each side of San Francisco Bay. Notwithstanding any other provision of this article, any such borrowing or issuance may take the form of successive issues or series of bonds, as may be determined by the authority to be in the public interest, which successive issues or series may be sold from time to time as the authority may determine. The approaches described in Section 30654 shall not be constructed by the authority or the department under this or any other law out of moneys in the State Highway Fund available for the maintenance or construction of state highways.

(Amended by Chapter 67, Statutes 1956.)

30658. The authority shall consider the possibility of financing through a loan from the Reconstruction Finance Corporation as well as the issuance of bonds under Chapter 1 of this division and shall adopt a method of financing deemed most desirable from the standpoint of interest costs, restrictions that might be imposed by the Reconstruction Finance Corporation, or under any proposed bond indenture, to the end that the best facility designed to meet traffic needs will be constructed at the lowest possible cost. Such financing shall include the pledging of the revenues from the existing San Francisco-Oakland Bay Bridge as well as those of the southern crossing. The authority may exercise any power conferred under Chapter 1 of this division with reference to the borrowing of funds or the issuance of bonds to accomplish the improvements mentioned in this article, and may borrow funds or issue bonds to provide funds as needed to carry on the work.

30659. The California Toll Bridge Authority Act and this article constitute, with respect to all other laws of this State, the latest legislative enactment with respect to the financing and construction of the Southern Crossing and the approaches thereto.

(Added by Chapter 304, Statutes 1955.)

APPENDIX B

U. S. ARMY INSTRUMENT OF APPROVAL

CORPS OF ENGINEERS, U. S. ARMY
OFFICE OF THE DISTRICT ENGINEER
SAN FRANCISCO DISTRICT
180 NEW MONTGOMERY
SAN FRANCISCO, CALIFORNIA

PEND Army Ver
Southern
Cl

Address reply to
DISTRICT ENGINEER
SAN FRANCISCO DISTRICT
CORPS OF ENGINEERS, U. S. ARMY
BOX 3050 RINCON ANNEX
SAN FRANCISCO 19, CALIFORNIA

Refer to File SPNKP 823 (S. F. Bay So Crossing) 26 April 1954

State of California
Department of Public Works
Sacramento, California

SACRAMENTO
[illegible] OFFICE
DEPT OF PUBLIC WORKS
1954 APR 27 AM 10 19

Gentlemen:

In compliance with your application dated December 31, 1953, there is inclosed an instrument of approval for the location and plans of a causeway-tube crossing of San Francisco Bay, from the vicinity of Army Street in San Francisco, to Bay Farm Island in Alameda, California.

Your attention is invited to the conditions under which this approval is granted, particularly conditions No. 3, 4, 10, 13, 14, 15, 16 and 17.

It should be understood that the approval granted by this instrument does not conclude that the Federal Government will grant approval for any extensions of this crossing or of any approach structures thereto, which may cross navigable waters. Any such structures must be the subject of separate applications and will be reviewed independently on the basis of the effect that they will have on navigation.

Very truly yours,

Geo. H. Walker
GEO. H. WALKER
Colonel, Corps of Engineers
District Engineer

1 Incl
Instrument of Approval

DEPARTMENT OF THE ARMY

INSTRUMENT

WHEREAS by Title V of an act of Congress approved August 2, 1946, entitled General Bridge Act of 1946 (Public Law 601-79th Congress) the consent of Congress was granted for the construction, maintenance, and operation of bridges and approaches thereto over the navigable waters of the United States;

AND WHEREAS section 502(b) of said act provides that: "The location and plans for such bridges shall be approved by the Chief of Engineers and the Secretary of the Army before construction is commenced, and, in approving the location and plans of any bridge, they may impose any specific conditions relating to the maintenance and operation of the structure which they may deem necessary in the interest of public navigation, and the conditions so imposed shall have the force of law;"

AND WHEREAS by section 10 of an act of Congress approved March 3, 1899, entitled "An Act making appropriations for the construction, repair, and preservation of certain public works on rivers and harbors, and for other purposes," it is provided that it shall not be lawful to build or commence the building of any wharf, pier, dolphin, boom, weir, breakwater, bulkhead, jetty, or other structures in any port, roadstead, haven, harbor, canal, navigable river, or other water of the United States, outside established harbor lines or where no harbor lines have been established, except on plans recommended by the Chief of Engineers and authorized by the Secretary of the Army; and it shall not be lawful to excavate or fill, or in any manner to alter or modify the course, location, condition, or capacity of any port, roadstead, haven, harbor, canal, lake, harbor of refuge, or enclosure within the limits of any breakwater, or of the channel of any navigable water of the United States, unless the work has been recommended by the Chief of Engineers and authorized by the Secretary of the Army prior to beginning the same (30 Stat. 1151; 33 U.S.C. 403);

AND WHEREAS the DEPARTMENT OF PUBLIC WORKS, STATE OF CALIFORNIA has submitted plans and a map of the location of a causeway-tube to be constructed across San Francisco Bay from Army Street, San Francisco to Bay Farm Island, Alameda in the State of California, which plans and map of location are hereto attached;

NOW THEREFORE, This is to certify that the location and attached plans of said causeway-tube are hereby approved by the Chief of Engineers and by the Secretary of the Army, pursuant to the above-mentioned acts of Congress, subject to the following conditions:

1. The district engineer in charge of the locality within which the causeway-tube is to be built may supervise its construction in order that said plans shall be complied with.

2. All work shall be so conducted so that the free navigation of the waterway shall not be unreasonably interfered with and the present navigable depths shall not be impaired. The channel or channels through the structure shall be promptly cleared of all falsework, piling, or other obstructions placed therein or caused by the construction of the causeway-tube, to the satisfaction of the said district engineer, when in his judgment the construction work has reached a point where such action should be taken, and in any case not later than ninety days after the causeway-tube has been opened to traffic.

3. The approval hereby granted shall cease and be null and void unless the actual construction of the causeway-tube be commenced within 5 years and completed within 10 years from the date of this instrument.

4. No deviation from the approved plans shall be made either before or after completion of the structure unless the modification of said plans has previously been submitted to and received the approval of the Chief of Engineers and of the Secretary of the Army.

5. Any material dredged in the prosecution of the work herein authorized shall be removed evenly, and no large refuse piles, ridges across the bed of the waterway or deep holes that may have a tendency to cause injury to navigable channels or to the banks of the waterway shall be left. Any material to be deposited or dumped under this authorization; either in the waterway or on shore above high-water mark, shall be deposited or dumped at the locality shown on the drawing hereto attached, and, if so prescribed thereon, within or behind a good and substantial bulkhead or bulkheads, such as will prevent escape of the material into the waterway.

6. If inspection or any other operations by the United States are necessary in the interests of navigation, all expenses connected therewith shall be borne by the grantee.

7. No attempt shall be made by the grantee or the owner to forbid the full and free use by the public of all navigable waters at or adjacent to the work or structure.

8. If future operations by the United States require an alteration in the position of the structures or work herein authorized, or if, in the opinion of the Secretary of the Army, it shall cause unreasonable obstruction to the free navigation of said water, the owner will be required, upon due notice from the Secretary of the Army, to remove or alter the structural work or obstructions caused thereby without expense to the United States, so as to render navigation reasonably free, easy, and unobstructed; and if, upon the expiration or revocation of this instrument,

the structures, fill, excavation, or other modification of the watercourse hereby authorized shall not be completed, the owner shall, without expense to the United States, and to such extent and in such time and manner as the Secretary of the Army may require, remove all or any portion of the uncompleted structure or fill and restore to its former condition the navigable capacity of the watercourse. No claim shall be made against the United States on account of any such removal or alteration.

9. The United States shall in no case be liable for any damage or injury to the structures or work herein authorized which may be caused by or result from future operations undertaken by the Government for the conservation or improvement of navigation, or for other purposes, and no claim or right to compensation shall accrue from any such damage.

10. The grantee shall notify the said district engineer at what time the work will be commenced, and as far in advance of the time of commencement as the said district engineer may specify, and shall also notify him promptly, in writing, of the commencement of work, suspension of work if for a period of more than one week, resumption of work, and its completion.

11. If, during the progress of the work, any plant, machinery, appliances or material are sunk, lost or thrown overboard, that in the opinion of the district engineer may be dangerous to or obstruct navigation, the grantee shall remove the same with the utmost dispatch. The grantee shall give immediate notice with description and location of such obstructions to the district engineer, and when so required by the district engineer shall mark or buoy such obstructions until the same are removed.

12. Whenever operations that will obstruct any part of the navigable channel are to be undertaken and approval of the district engineer therefor has been obtained, the grantee shall, at its own expense, cause navigation interests to be notified in advance of the proposed obstruction by publication in at least two prominent local daily papers and in "Notice to Mariners" of the U. S. Coast Guard, as well as by circular letter to all persons, companies, or corporations owning or operating plant in the waterway to the satisfaction of the district engineer. If the work of construction is prosecuted intermittently, the notices herein required shall be given in each instance, allowing a reasonable time, but not less than five days in advance of the proposed work.

13. Such lights, signals, and other aids to navigation in addition to those prescribed by law, as may be required by the Chief of Engineers and approved by the United States Coast Guard for the safety of navigation shall be installed and maintained by and at the expense of the owners of the crossing both during and after construction.

14. Such dolphins, falsework, survey platforms, mooring buoys, etc., or any obstructions to navigation, that may be necessary in connection with construction of the crossing shall require the prior written approval of the district engineer.

15. Such initial dredging to a depth of thirty-five (35) feet below M.L.L.W. as, in the opinion of the district engineer, may be required south of the proposed bridge to provide a suitable navigation approach to Islais Creek Channel equivalent to that existing, shall be performed by and at the expense of the owners prior to commencement of construction of the crossing.

16. Such fenders as may be found necessary in the interest of navigation and ordered and approved by the Chief of Engineers, shall be constructed and maintained by and at the expense of the owners.

17. It is understood that the depth of fifty (50) feet (below M.L.L.W.) over the 1,500-foot channel section of the tunnel as shown on the attached plans is to the top of a 5-foot cover over the tunnel.

IN WITNESS WHEREOF I have hereunto set my hand by direction of the Chief of Engineers this—8th—day of—April—1954

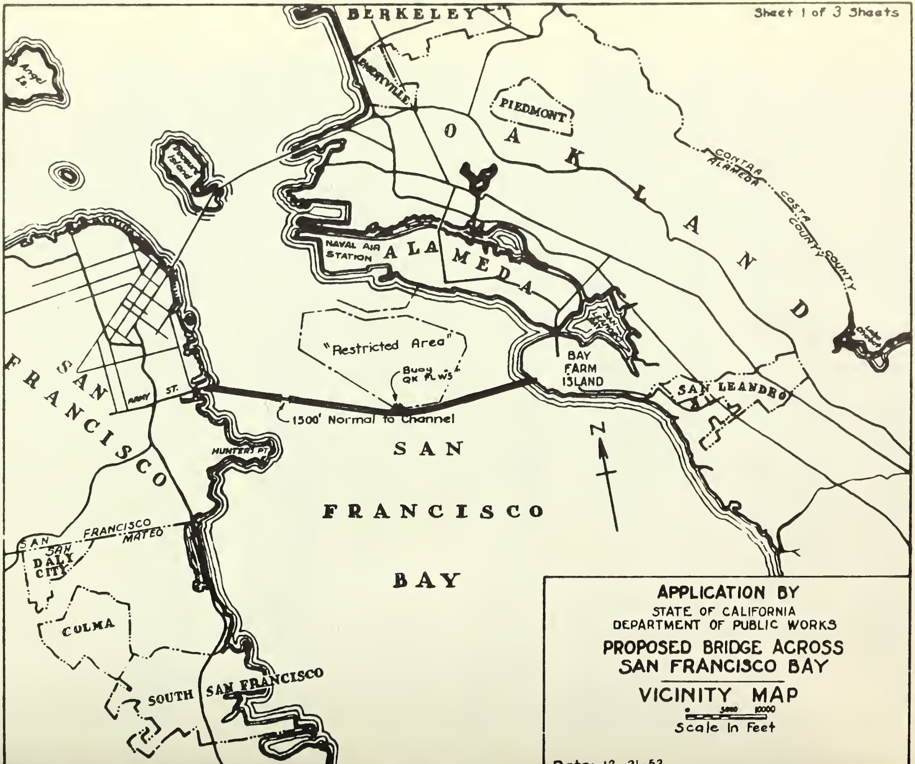
E. C. Itschner

E. C. ITSCHNER
Brigadier General, USA
Assistant Chief of Engineers
for Civil Works

IN WITNESS WHEREOF I have hereunto set my hand by direction of the Under Secretary of the Army this— 9 —day of—April—1954

SHERRY B. MYERS
Lt. Col., JAGC
Chief, Legal Branch
OUSA

Sheet 1 of 3 Sheets



APPLICATION BY
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS

PROPOSED BRIDGE ACROSS
SAN FRANCISCO BAY

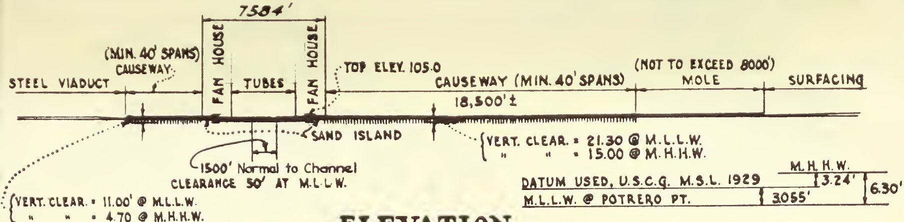
VICINITY MAP

0 5000 10000
Scale In Feet

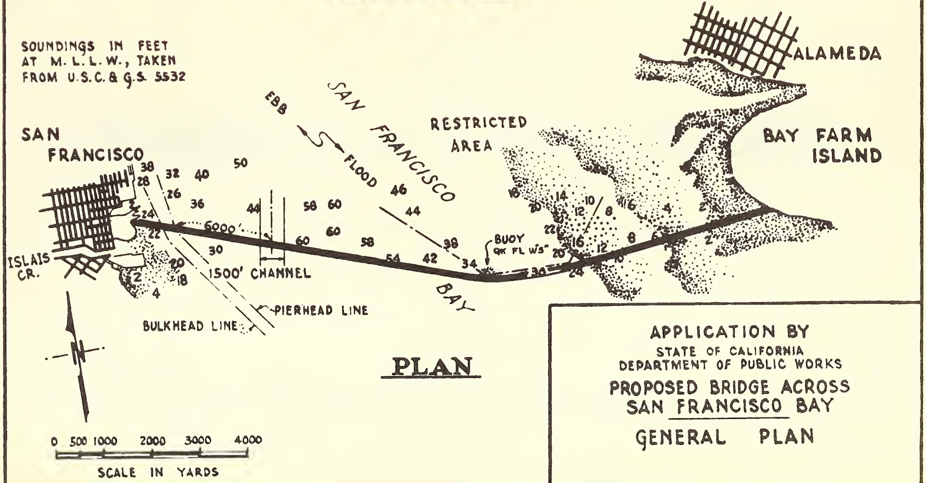
Date: 12-31-53

E 6-53

SHEET 2 OF 3 SHEETS



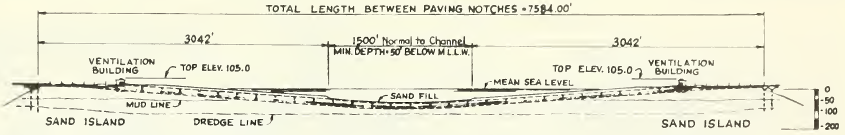
ELEVATION



PLAN

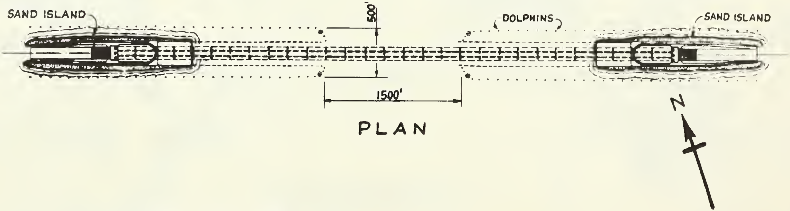
APPLICATION BY
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
PROPOSED BRIDGE ACROSS
SAN FRANCISCO BAY
GENERAL PLAN

DATE : 10-21-53

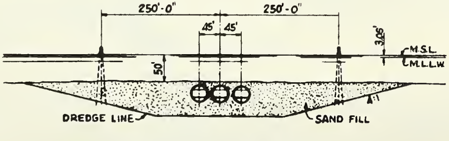


ELEVATION

SAN FRANCISCO BAY



PLAN



CHANNEL SECTION

0 50 100 200
SCALE IN FEET

APPLICATION BY
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS

PROPOSED BRIDGE ACROSS SAN FRANCISCO BAY

SAND FILL - TUBE SECTION

0 500 1000
HORIZONTAL SCALE IN FEET
VERTICAL SCALE: AS SHOWN

DATE - 12-31-53

AHM 6-53

City

Co.